15 US 285

# RECORD, CASE No. 14,142.

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1892.

TERM No., ~~424~~. 176

THE SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY, APPELLANT,

*vs.*

GORDON, STROBEL AND LAUREAU (LIMITED), COMPOSED OF FREDERICK W. GORDON, VICTOR O. STROBEL, LEWIS S. LAUREAU, AND THOMAS G. BOYLE.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE NORTHERN DISTRICT OF ALABAMA.

FILED SEPTEMBER 11, 1890.

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1 To the honorable judges of the circuit court of the United States, sitting at Huntsville, for the northern division of the northern district of the State of Alabama:

Frederick W. Gordon, Victor O. Strobel, Lewis G. Laureau, and Thomas G. Boyle, citizens of and residing in the State of Pennsylvania, parties under the firm name of Gordon, Strobel & Laureau, Limited, bring this their petition against the Central Trust Company of New York, a corporation organized and existing under the laws of the State of New York, having its domicil or principal place of business in the city of New York; the Sheffield & Birmingham Coal, Iron & Railway Company, a corporation organized and existing under the laws of the State of Alabama, having its domicil or principal place of business in the city of Sheffield, in the northern division of the northern district of the State of Alabama; Charles D. Woodson, and Jacob G. Chamberlain, citizens of the State of Alabama, residing in said division and district, and thereupon your petitioners, complaining, say:

1. That heretofore, on the 9th day of January, 1889, the said Central Trust Company filed in this court its original bill of complaint against said Sheffield and Birmingham Coal, Iron and Railway Company and said Charles D. Woodson, which is yet pending and undetermined. In and by said bill it is alleged, among other things, that on or about the 2nd day of January, 1888, the said coal, iron and railway company made and executed its deed of trust and mortgage, wherein and whereby was conveyed to said trust company, with other property in said deed of trust and mortgage described, three iron coke blast furnaces on the south bank of the Tennessee river at Sheffield, in Colbert county, in the State of Alabama, which, as is, in said deed recited, were then being constructed by said coal, iron and railway company at a cost of five hundred and sixty-four thousand dollars (564,000), paid to the contractors, which said furnaces were situated on a certain tract or parcel of land in said deed particularly described, containing fifty acres, a copy of
2 which deed of trust and mortgage is exhibited with said original bill marked "Exhibit A," and in and by said bill it is further alleged that said deed of trust and mortgage were executed to secure the payment of one million of dollars of bonds made by the said mortgagor, said Sheffield and Birmingham Coal, Iron and Railway Company, on or about the 2nd day of January, 1888, which said bonds were thereafter negotiated and sold by the said company to the amount of nine hundred and eighty-seven thousand dollars in the payment of the interest thereon due and payable on the first day of January, 1889, the said mortgage had made and remained in default, whereby the conditions of the said deed of trust and mortgage were broken.

2. In and by said bill it is further alleged that on or about the 1st day of June, 1888, the said Sheffield and Birmingham Coal, Iron and Railway Company made and executed to the complainant, said Central Trust Company of New York, a certain other deed of trust

and mortgage, wherein and whereby was conveyed the furnaces aforesaid and the lands whereon said furnaces are situate, with other property & rights of properties, to secure the payment of ofour hundred thousand dollars of bonds made by said mortgagor, a copy of which deed of trust and mortgage is exhibited with said bill, marked "Exhibit B," and the said bonds for which said deed of trust and mortgage purports to be a security, were, it is in and by said bill alleged, negotiated and sold by said mortgagor; and it is further in and by said bill alleged that said Sheffield and Birmingham Coal, Iron and Railway Company on the 1st day of January, 1889, made and remained in default in payment of the interest due and payable on said bonds, whereby the conditions of said deed of trust and mortgage became and were broken.

3. The prayer of said bill, among other things, is for the appointment of a receiver or receivers "to take possession of all and singular the said mortgaged property, with the usual powers of receivers in such cases, with power to manage and operate the said railroad and other property therein described, and all its earnings and increase during the pendency of this suit, and with such
3 powers as to this court shall seem right and proper." In said bill, the said Sheffield and Birmingham Coal, Iron and Railway Company and said Charles D. Woodson, as a holder of the bonds aforesaid of said company, are made parties defendant.

4. On the 12th day of January, 1889, on the presentment of said bill to Hon. Don A. Pardee, the circuit judge of this district, in vacation, and order was made on said bill that the defendant, said Jacob G. Chamberlain, be appointed receiver of all and singular the property mentioned and described in the said deeds of trust and mortgage; that he give bond for the faithful performance of his duties as receiver, and that he take possession of all said property, subject to the further order of the court; which said order was filed in this court on the 15th January, 1889, and said defendant Chamberlain, as such receiver, gave bond with surety, approved by the clerk of this court, with condition for the faithful performance of his duties as receiver, and as such receiver said defendant has taken possession and now holds possession of all said property, including said three blast furnaces and said sixty acres of land.

5. Your petitioners further show that on the 9th day of February, 1887, they proposed in writing to the Alabama and Tennessee Coal and Iron Company, a corporation then existing, organized under the laws of the State of Tennessee, having and holding in fee simple the sixty acres of land, hereinbefore referred to, on which said three blast furnaces are situate, to construct said three blast furnaces according to specifications in said writing particularly stated for the sum of five hundred and sixty-four thousand dollars; which proposition was accepted in writing by said company and thereby became a contract by and between your petitioners and said company. A copy of said contract is herewith filed, marked A B, and prayed to be taken as part of this bill.

6. By the said contract your petitioners agreed to furnish the material and construct said three blast furnaces according to the

specifications therein stated for the sum of five hundred and sixty-four thousand dollars, the work to be done in a good
4 and workmanlike manner and of suitable material, each part being adequate in design, strength, capacity, and workmanship for the purpose for which it is intended.

And in and by said contract it was and is stipulated and agreed that the superintendent of said company should, while the work of furnishing the material and constructing the said furnaces was being done, every two weeks pass upon the said work, and if the said work was done to the satisfaction of said superintendent it should be a final acceptance thereof, so far as done, by said company. While said work was being done payments were to be made your petitioners by said company on a basis of ninety per cent. of the value of all material delivered and of all work done, the valuation of said materials being estimated at said furnaces, except the blowing engines, the valuation whereof was to be made according to their advancement in construction at the shops; so that during the construction of the said furnaces it was estimated that there would be paid to your petitioners the sum of five hundred and seven thousand six hundred dollars, leaving due to them on the completion of said work fifty-six thousand four hundred dollars, which was to be paid as follows: Six thousand four hundred dollars within thirty days and fifty thousand dollars in the three notes of said company, each for the sum of sixteen thousand six hundred and sixty-six $\frac{66}{100}$ dollars, and each bearing interest at the rate of six per cent. per annum, one of said notes being payable at four months, one at eight, and one at twelve months, and payment of all of said notes to be secured by the first-mortgage bonds of said company.

And in and by said contract it is stated that the estimate therein made were by your petitioners based on a freight rate of 13½ cents per 100 lbs. from Cincinnati to the site of construction, and this rate of freight was by said company guaranteed and so made good to your petitioners.

7. And in and by said writing your petitioners proposed for an additional remuneration of twenty thousand dollars, in the
5 event ore and coke of certain qualities were furnished them, to guarantee a certain product of and from said furnaces, but this proposal was not accepted by said company, and in the event of its non-acceptance it is in said writing stated that it will be the duty of your petitioners to give each of said furnaces, as put in blast, personal attention, supervising their operation and attaining as perfect an action and as high a duty as your petitioners could.

8. Your petitioners further state that they were engaged in the construction of said furnaces under said contract on the 2nd day of January, 1888, when the deed of trust and mortgage aforesaid of that date were by the defendant The Sheffield and Birmingham Coal, Iron and Railway Company executed to the defendant The Central Trust Company of New York, and the three iron coke blast furnaces in said mortgage mentioned as being constructed by the said coal, iron and railway company at a cost of five hundred and

sixty-four thousand dollars, payable to the contractors, were the said furnaces so being constructed by your petitioners.

And your petitioners further state that in pursuance of said contract, and according to the specifications therein contained, they constructed said work, furnishing all materials which they were bound to furnish, the work being passed upon every two weeks by said superintendent of said Alabama and Tennessee Coal and Iron Company until the consolidation and merger of said company in the Sheffield and Birmingham Coal, Iron and Railway Company, as hereinbefore stated, and thereafter said work was passed upon by the superintendent of said last-named company every two weeks until the final completion thereof, and was by said superintendent found to be done to his satisfaction and was by him accepted, and the construction of said three furnaces were by your petitioners completed according to said contract and the specifications therein contained on the 8th day of August, 1888.

And after deducting all payments made to your petitioners there was then owing to them for work and labor done and performed and materials furnished under said contract the sum of fifty-
6 nine thousand one hundred and eighteen $\frac{16}{100}$, including therein nine thousand six hundred and eighteen $\frac{16}{100}$ dollars, being the excess of freight which your petitioners were compelled to pay for the transportation of materials, engines, &c., from Cincinnati to the site of construction of said furnaces over and above 13½ cents per 100 lbs. guaranteed to petitioners in and by said contract; and thereafter, on the 1st day of November, 1888, there became due to your petitioners the further sum of eleven hundred and ninety-four $\frac{50}{100}$ dollars for extra materials furnished for said furnaces by your petitioners at the instance and request of said Sheffield and Birmingham Coal, Iron and Railway Company, making the aggregate due to your petitioners sixty thousand three hundred and twelve $\frac{66}{100}$ dollars.

9. And your petitioners further state that while they were engaged in constructing said furnaces under said contract on or about the 25th day of August, 1887, the said Alabama and Tennessee Coal and Iron Company, by proceedings had under a special act of the General Assembly of the State of Alabama, approved the 28th day of Feb'y, 1887, became consolidated with and merged into the said Sheffield and Birmingham Coal, Iron and Railway Company, and the said Sheffield and Birmingham Coal, Iron and Railway Company, *and the said Sheffield and Birmingham Coal, Iron and Railway Company*, thereby succeeded to all the property, right of property, franchises, rights, and privileges, and became subject to all the contracts, engagements, debts, and liabilities of said Alabama and Tennessee Coal and Iron Company, and thereafter all the work done and performed and materials furnished by your petitioners under said contract for the construction of said three furnaces were done, performed, and furnished for said Sheffield and Birmingham Coal, Iron and Railway Company, and the said work was finally and fully done and performed, passed upon, and accepted by the superintendent of said company on the 8th day of August, 1888; and, as is

hereinbefore stated, there was then owing to petitioners because of the said work and labor so done and performed and materials furnished and because of the said excess of freights the aggregate
7 sum of fifty-nine thousand nine hundred and thirty-two $\frac{69}{100}$ dollars ($59,932.69).

10. On the 8th day of September, 1888, by letter addressed to said company and delivered to its president and vice-president and general manager, petitioners requested said company to pay nine thousand nine hundred and thirty-two $\frac{69}{100}$ dollars of said sum of fifty-nine thousand nine hundred and thirty-two $\frac{69}{100}$ dollars, and for the remaining fifty thousand dollars to make their three several promissory notes, each for the payment of sixteen thousand six hundred and sixty-six $\frac{66}{100}$ dollars, bearing interest at the rate of six per cent., one payable at four, one payable at eight, and one payable at twelve months, secured by the first-mortgage bonds of said company, but said company refused compliance with said request and refused to keep and perform said contract on their part.

11. And petitioners further say that said furnaces were designated by said company as furnace "A," furnace "B," furnace "C," thereby distinguishing them severally and respectively.

Prior to August 8th, 1888, petitioners gave personal attention to the putting in blast the furnace designated "A," and thereafter, on or about September 7th, petitioners gave personal attention to the putting in blast the furnace designated as furnace "B," and petitioners supervised the operation of the said furnaces, attaining for them a perfect action and as high a duty as they could, and on the 5th September, 1888, petitioners notified said company that so soon as furnace "B" was put in blast they would be ready to give personal attention to the putting in blast furnace "C," and to supervise the same, and would expect said company to go on with the work, but the said company refused to put said furnace in blast or to designate any time for putting the same in blast, and has not designated any time for putting the same in blast or afforded your petitioners the opportunity of giving personal attention to the same.

12. Petitioners state that under and pursuant to the statutes of the State of Alabama they have a lien on the said furnaces, the fixtures, machinery, engines, boilers, thereto attached and
8 belonging, and the land on which they are situate to the extent of one acre, the said land not being in a city, town, or village, for the payment of the said balance due and owing them of sixty thousand three hundred and twelve $\frac{65}{100}$ dollars, with the accruing interest thereon, in preference to and priority over the mortgage deeds of trust to said Central Trust Company in the said original bill mentioned; and your petitioners further state that on the 18th day of January, 1889, they filed in the office of the judge of probate of the county of Colbert, in the State of Alabama, in which county said furnaces and land are situate, their claim of such lien, containing a description of the property on which such lien is claimed, with a statement in writing verified by the oath of James C. Gray, and agent of petitioners, having knowledge of the facts, containing a just and true account of the demand of petitioners

after all just credits had been given. A copy of the claim and statement so filed in the office of said probate judge is herewith filed and marked C D and prayed to be taken as part of this petition. In and by said claim it is shown and such is the fact that the land on which said furnaces, with the fixtures, machinery, engines, and boilers thereto attached and belonging, are situate is not in a city, town, or village, and exceeds in area one acre; and it is in and by said statement shown that petitioners selected one acre of said land in said claim particularly described as subject to the lien, and for the description of said one acre reference is here now made to the copy of said claim filed, marked Exhibit C D.

Wherefore petitioners pray that this petition may be filed in said cause pending in this court wherein said Central Trust Company of New York is complainant and said Sheffield and Birmingham Coal, Iron and Railway Company and said Charles D. Woodson are defendants, and that notice thereof may be given said complainant and said defendants and said Jacob G. Chamberlain, receiver as aforesaid.

That for the protection and inforcement of their rights petitioners may be permitted by the order of the court to intervene in said cause; that the court will inquire into, ascertain, establish, and enforce their lien as herein stated in and on said furnaces, the fixtures, engines, machinery, and boilers thereto attached and belonging, and on the said one acre of land on which the same are situate, and for all such other and further relief as the case may require.

BRICKELL AND HARRIS,
*Solicitors for Petitioners.*

Gordon, Strobel & Laureau, L'd, Philada., Pa.

(Copy.)

NASHVILLE, TENN., *Feb'y 9th*, 1887.

Ala. & Tenn. C. & I. Co., Nashville, Tenn.

DEAR SIRS: We hereby submit you specifications for the construction of three blast furnaces, with the following drawings:

Blast-furnace section—
Bosh cooling plates.
Tuyere stocks.
Down comer details.
Hoist-tower.
Blowing-engine section—
Air valves.
Steam valves.
Hot-blast stove elevation and section—
Top brick-work & details.
Bottom brick " "
Hot-blast valve.
Cold-blast valve.

Chimney valve.
Gas-inlet valve.
General arrangement.

These drawings are to serve as illustrations of the construction of the plants and in connection we submit specifications of the following:

Blast furnaces.
Fire-brick stoves.
Blowing engines.
Casting-houses.
Boilers.

Stock-house, charging barrows, engine-house, feed-pumps, heaters, river pumps, dry well, tanks, hoist-tower, hoist-engines, hot-blast main, cold-blast main, sewers, flues, reservoir, foundations, miscellaneous.

In compliance with these specifications we will furnish all the material and construct for you three blast furnaces on a
11 suitable location in Sheffield, Ala., to be selected by you; all work to be done in good and workmanlike manner and of suitable material, and each part to be adequate in design, strength, capacity, and workmanship for the purpose to which it is intended, for the sum of $564,000.00.

Your sup't shall pass upon the work every two weeks, and if to his satisfaction it shall be a final acceptance by you so far as done. But if not in compliance with the contract and to his satisfaction as to quality of material or character of workmanship, we agree to make it so as rapidly as possible.

This price includes all patent licenses for devices embraced in the construction. We have estimated on making red brick and quarrying some of the stone on the side, and in accepting this proposition you grant us adequate privileges at such points as will not injure the property. These specifications intend to embrace a description of the entire plant, with the exceptions noted, and we agree to finish one of these furnaces in 13 months from date of contract, the second in 15 months, and the entire plant in 17 months; provided we are not actually or seriously detained by the want of proper railroad connections to the site. These will be needed very soon for the delivery of foundation materials and the machinery needed in the construction of these foundations.

If within 30 days "the railroad connection to the site" is made, we will claim no detention. Otherwise all time thereafter and until the time such connection is made shall be added to the 13, 15, & 17 months herein specified for the completion of the furnaces severally.

We have based our estimates on a freight rate of 13½ cts. per 100 lbs from Cincinnati, O., to the site of construction, which rate is to be guaranteed and made good by you.

Payments to be made on the 15th of each month, on a basis of 90 % of the value of all the materials delievered and the value of the work executed thereon on the ground, except the blowing engines,

upon which 90 % valuation is to be made, according to their
12 advancement in the shop, making the total cash payments during the progress of the work $507,600 and $6,400 within 30 days after the full completion of the contract and the $50,000 balance in the company's paper at 4, 8, & 12 months, each note being for $16,666.66, bearing interest at 6 % per annum from their dates. These notes are to be secured by the first-mortgage bonds of the Co. of equal amounts.

We further propose for an additional remuneration of $20,000 to supervise the blowing in of one furnace, and will guarantee that it shall make a product of 4,200 gross tons of 2,240 lbs. each during 30 consecutive days, provided the ores are brown hematite and contain 50% metallic iron.

Or we will guarantee a product of 3,600 tons in 30 consecutive days if you provide the same character of ores containing only 45% metallic iron, and a product between 4,200 and 3,600 tons in proportion to the percentage of iron in the ores between 50% & 45%. The percentage of metallic iron in the ores is to be determined by the consumption of ore compared to the product of pig-iron. The foreign earths in the limestone are not to exceed 3½% and the coke to be equal to that manufactured by the Pratt C. & I. Co. made from their run of the mines. The ore must be of fairly even character, being mined with care.

If any question arises as to the quality of the coke you are to suppiy properly made coke from the Pratt run of the mines.

Neither are the monies remaining in your hands, after paying us 90% of the contract price, nor the additional $20,000 shall become due until a product as specified has been attained, but when it is attained then you are to pay us the full amount, viz., $76,400 in money and notes, as above stated, immediately upon the completion of the plant, if not then done.

The latter proposition, given as a guarantee of the performance of one furnace, is to establish the merits of said furnaces as to product, and will be left open for your acceptance for six months after signing the former proposition. If you do not accept the latter
13 proposition we shall give each of the three furnaces as put in blast our personal attention, supervising their operation and attain for you as perfect an action and as high a duty as we can which shall be considered our duty as a part of our first proposition.

(Signed) GORDON, STROBEL & LAUREAU, LIMITED.

Signed in duplicate.

(Approved.)

FRED. W. GORDON, *Chairman.*
VICTOR O. STROBEL, *Treasurer.*

The Alabama & Tenn. Coal & Iron Co. accept this proposition with the distinct understanding that the condition and terms of

guaranty of production remain open for our decision and acceptance for six months.

(Signed) ALA. & TENN. C. & I. CO.
A. S. COLLYER, *Pres't.*

J. B. KILLEBREW, *Sec't'y.* [SEAL.]

EXHIBIT "A B."

14 The Sheffield and Birmingham Coal, Iron and Railway Company, successors to the Alabama and Tennessee Coal and Iron Company, to Gordon, Strobel and Laureau, Limited, Dr.

| | | |
|---|---|---|
| To total contract amount | $564,000 00 | |
| " freight excess payments as per 13½c. clause in contract | 9,618 16 | |
| " extra material furnished Sept. 21, Oct. 16, and Oct. 29, 1888, as per Nov. 1st statement | 1,194 50 | |
| | | 574,812 66 |

CR.

| | |
|---|---|
| By payments to date (Jan'y 18th, 1889) | 514,500 00 |
| Balance due | $60,312 66 |

15 THE STATE OF ALABAMA, }
*Morgan County.* }

Before me, W. T. Mulligan, a notary public in and for the county of Morgan, State of Alabama, this day personally appeared James C. Gray, who, being duly sworn, deposeth and saith that he is the duly authorized agent of Gordon, Strobel and Laureau, Limited, contractors, engineers, and constructors; that on the 9th day of February, 1887, said Gordon, Strobel and Laureau entered into a contract in writing with the Alabama and Tennessee Coal and Iron Company whereby they agreed to construct for said company three blast furnaces according to specifications in said contract mentioned at and for the aggregate sum of five hundred and sixty-four thousand dollars, of which sum five hundred and seven thousand six hundred was payable during the progress of the work of construction, six thousand four hundred dollars within thirty days after completion, and fifty thousand dollars in the three notes of the said company for sixteen thousand six hundred and sixty-six $\frac{66}{100}$ dollars, payable respectively at four, eight, and twelve months, each bearing six per cent. interest, to be secured by first-mortgage bonds of the company.

And affiant further states that in 1887, while said Gordon, Strobel and Laureau were constructing said furnaces under said contract, the said Alabama and Tennessee Coal and Iron Company became consolidated with and merged in the Sheffield and Birmingham Coal, Iron and Railway Co., and thereafter for said Sheffield and

Birmingham Coal, Iron and Railway Company said Gordon, Strobel and Laureau continued under said contract the construction of said furnaces to completion, completing the same on the 8th day of August, 1888. The lands on which the said furnaces are situate lie within the county of Colbert, State of Alabama, near to the city of Sheffield, and the parcel in which they are situate is known and described as follows: A certain parcel located within a sixty-acre tract conveyed by the Sheffield Land, Iron and Coal Company to
16 the Alabama and Tennessee Coal and Iron Company, which conveyance is on record in the office of the judge of probate of said county of Colbert, in Record Book "J," pp. 268–'72, and plan of same on p. 273, beginning at a stone set in the ground at the east corner of said sixty-acre tract, thence running south 41 30 west eight hundred and fifty-three $\frac{8}{10}$ feet along the southeast boundary of said sixty-acre tract to a stone set in the ground, thence turning and running north 58 west five hundred and fifty-four $\frac{4}{10}$ feet to the east corner of the parcel of land to be described; beginning at this point and running in a northwesterly direction parallel with and twenty feet distant from a building used as an engine-house a distance of one hundred and eighty-two feet, thence turning at right angles and running a southwesterly direction a distance of five hundred and sixty-five feet, thence turning at right angles running in a southeasterly direction a distance of three hundred and fifteen feet, thence turning at right angles and running in a northeasterly direction a distance of five hundred and eleven feet parallel with and fifteen feet southeast of a building called a stock-house, thence turning at right angles and running in a northwest direction a distance of one hundred and thirty-three feet, thence turning at right angles and running in a northeasterly direction a distance of fifty-four feet parallel with and ten feet southeast of the building used as an engine-house to the point of beginning. Of this parcel of land on which said three furnaces are situated the said Gordon, Strobel and Laureau have selected as subject to the lien herein and hereby claimed one acre, known and described as follows: A certain parcel located within a sixty-acre tract conveyed by the Sheffield Land, Iron and Coal Company to the Alabama and Tennessee Coal and Iron Company, which conveyance is of record in the office of the judge of probate of said county of Colbert, in Record Book "J," pp. 268–'72, and plan of same on p. 273, beginning at a stone set in the ground at the east corner of said sixty-acre tract, thence running south 41 30 west eight hundred and fifty-three $\frac{8}{10}$ feet along the southeast boundary of said sixty-acre tract to a stone set in the ground; thence turning and running north 58 west five hundred and fifty-four $\frac{4}{10}$ feet to
17 the east corner of the parcel of land to be described; beginning at this point and running in a northwesterly direction parallel with and twenty feet distant from a building used as an engine-house a distance of one hundred and thirty feet; thence turning at right angles and running in a southwesterly direction a distance of one hundred sixty-one $\frac{5}{10}$ feet; thence turning at right angles and running in a southeasterly direction parallel with the most easterly east house a distance of ninety-three feet; thence

turning at right angles and running in a southwesterly direction a distance of sixty-six and $\frac{5}{10}$ feet; thence turning at right angles and running in a southeasterly direction a distance of forty feet; thence turning at right angles and running in a southwesterly direction a distance of seventy-eight feet; thence turning at right angles and running in a northwesterly direction a distance of forty feet; thence turning at right angles and running in a southwesterly direction a distance of fifty-one and $\frac{5}{10}$ feet; thence turning at right angles and running in a southeasterly direction a distance of forty feet; thence turning at right angles and running in a southwesterly direction a distance of seventy-eight feet; thence turning at right angles and running in a northwesterly direction a distance of forty feet; thence turning at right angles and running in a southwesterly direction a distance of fifty-one and $\frac{5}{10}$ feet; thence turning at right angles and running in a southeasterly direction a distance of forty feet; thence turning at right angles and running in a southwesterly direction a distance of seventy-six feet; thence turning at right angles and running in a southeasterly direction a distance of thirty feet; thence turning at right angles and running in a northeasterly direction parallel with and fourteen feet southeast from a line through the center of nine (9) fire-brick hot-blast stoves a distance of five hundred and nine feet; thence turning at right angles and running in a northwesterly direction a distance of thirty-three feet; thence turning at right angles and running in a northeasterly direction a distance of fifty-four feet parallel with and ten feet southeast of a building called an engine-house to the point of beginning.

18 Affiant further states that he has personal knowledge of the facts, and that there was, on the 8th day of August, 1888, when said furnaces were completed, owing by said Sheffield and Birmingham Coal, Iron and Railway Company to said Gordon, Strobel and Laureau the sum of fifty-nine thousand one hundred and eighteen and $\frac{16}{100}$ dollars for works and labor in and upon said furnaces done and performed under said contract, and for materials, fixtures, engines, boilers, and machinery furnished for said furnaces in and under said contract.

And on the first day of November, 1888, there was owing and due to them the further sum of eleven hundred and ninety-four and $\frac{50}{100}$ dollars for extra material furnished for said furnaces, making the aggregate of sixty thousand three hundred and twelve and $\frac{66}{100}$ dollars owing by said Sheffield and Birmingham Coal, Iron and Railway Company to said Gordon, Strobel and Laureau after giving and allowing to said company all just credits and payments for such works and labor and for such materials, fixtures, boilers, engines, and machinery for said furnaces.

A just and true account of the said demand is hereto appended and herewith verified.

For the payment and security of said sum of sixty thousand three hundred and twelve and $\frac{66}{100}$ dollars said Gordon, Strobel and Laureau, a partnership composed of Frederick W. Gordon, Victor O. Strobel, Lewis G. Laureau, Thomas G. Boyle, claim a lien under

the statutes on the said furnaces, the fixtures, machinery, and boilers and engines thereto attached and belonging, and also on the one acre of land hereinbefore described as selected by them and subject to the said lien.

The said Sheffield and Birmingham Coal, Iron and Railway Company is the owner and proprietor of said one acre and of said furnaces, fixtures, engines, boilers, and machinery; and the said one acre includes the three furnaces, nine fire-brick hot-blast stoves, three wrought-iron hoist-towers, three hoist-engines, seven blowing engines, seven feed-water heaters, three boiler feed-pumps, three duplex circulating water pumps, twelve water tube-boilers,
19 three boiler-draught stacks, one brick engine-house, one brick pump-house, three brick engine-houses, hot and cold blast main connections, steam and water pipes, fittings, valves, etc., connecting the above-named parts; also two (2) wrought-iron water tanks, foundations and underground brick flues for the above-described works.

(Signed) JAMES C. GRAY.

Subscribed to and sworn to before me this 18th day of January, 1889.

(Signed) W. T. MULLIGAN,
*Notary Public.*

Endorsed: No. 150. Gordon, Strobel & Lareau *v.* Central Trust Co. *et al.* Petition. Exhibit C & D. Filed in clerk's office February 11, 1889. A. W. McCullough, clerk.

20 *Notice of Petition, Original.*

UNITED STATES OF AMERICA:

Circuit Court, Northern Division, Northern District of Alabama.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY *et als.* } In Equity.

The Central Trust Company of New York and the defendants, The Sheffield and Birmingham Coal, Iron and Railroad Company and Charles D. Woodson and Jacob G. Chamberlain, receiver appointed in the above-entitled cause, will take notice that on the 11th day of February, 1889, Gordon, Stroubel and Lareau filed in said cause their petition, praying to be allowed to intervene in said cause and praying the court to establish and enforce a lien on three iron blast coke furnaces, the fixtures, machinery, engines, boilers thereto attached and belonging, and one acre of land in said petition described, on which said furnaces are situated, which said furnaces

are in the possession of the said receiver, as is in said petition alleged. A copy of said petition will be furnished on application.

Witness my hand this 12th day of February, 1889, at office.

A. W. McCULLOUGH, *Clerk.*

Endorsed: "Returned and filed February 14th, 1889. A. W. McCullough, clerk."

Further endorsed: Rec'd in office February 12th, 1889. Executed by serving a copy on J. G. Chamberlain, receiver, in Sheffield, Ala., Feb. 12th, 1889, & C. D. Woodson, and a copy on Lawrence Cooper, solicitor for S. & B. Coal, Iron & R'y Co., in Huntsville, Ala., Feb'y 14, 1889. A. H. Keller, U. S. M., per Geo. P. Turner, deputy.

21 *Order Appointing Special Master.*

UNITED STATES OF AMERICA:

In the Circuit Court of the United States for the Northern Division of the Northern District of Ala., April Term, 1889.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY *et als.* } 150. In Equity.

This cause was, by consent of parties, submitted at the present term for decretal orders on the petition of Gordon, Stroubel and Lareau, Limited, First National Bank of Sheffield, A. O. Beebe, and Henry B. Tompkins filed and to be filed in this cause; and, all parties, by their counsel, consenting to the following decretal orders, the same are entered and enrolled as the orders of the court in this cause.

It is ordered, adjudged, and decreed that the several petitioners, Gordon, Stroubel and Lareau, Limited, First National Bank of Sheffield, A. O. Beebe, and Henry B. Tompkins, be permitted and allowed to intervene in this cause, and that the petition filed by each of them be taken and deemed as the several and respective interventions of each of them, and of the said petitions severally and respectively and of the matters and things therein stated this court takes and assumes jurisdiction.

It is further ordered, adjudged, and decreed that David D. Shelby, Esquire, as member of the bar of this court, be, and he is, appointed special master in chancery, who shall execute the several orders of reference hereinafter made.

22 It is further ordered, adjudged, and decreed that the petition of Gordon, Stroubel and Lareau, Limited, be, and the same is, referred to said special master to inquire and state to the court whether the matters and things therein alleged be true, and also to inquire and state whether the matters and things stated in the answer to said petition be true; and the said master will particularly inquire and report whether the Alabama and Tennessee

Coal and Iron Company made and entered into the contract with the petitioners alleged in the fifth, sixth, and seventh paragraphs of the petition; whether under and in pursuance of the said contract the petitioners constructed the three blast furnaces as in said petition alleged; what payments were made to them for the construction of said furnaces by the said Alabama and Tennessee Coal and Iron Company or by its successor, the defendant The Sheffield and Birmingham Coal, Iron and Railway Company; what, if any, amount remains due and unpaid to the petitioner under the said contract because of the work and labor done, materials furnished, or other proper charges in the construction of said furnaces; and, further, to inquire and report whether *petitioner* petitioners have the lien claimed by them and the nature, character, and extent of such lien; and, further, to inquire and report upon all matters of defense specially stated in the said answer to the said petition.

It is further ordered, adjudged, and decreed that the petition of said First National Bank of Sheffield be, and the same is, referred to said special master to inquire and report to the court whether the matters and things therein alleged be true, and particularly to inquire and report whether the defendant The Sheffield and Birmingham Coal, Iron and Railway Company is indebted to the said petitioner as in said petition alleged, and whether the mortgage in the second paragraph of said petition alleged was made and executed by the said defendant.

23 It is further ordered, adjudged, and decreed that the several petitions of said A. O. Beebe and said Henry B. Tompkins be respectively referred to said special master, and that he inquire and report whether the defendant The Sheffield and Birmingham Coal, Iron and Railway Company is indebted to the said petitioners respectively as in the said petition is alleged.

It is further ordered, adjudged, and decreed that the said special master in the execution of the said orders of reference or either of them shall fix the time and place of executing the same, of which he will give due and reasonable notice to the counsel of record of the parties in interest, and may adjourn the execution of such reference from time to time as he may deem right and proper, and shall have full authority to examine any of the parties upon oath touching all matters contained in the reference, and also to require from the parties the production of all books, papers, writings, or other documents in their possession or under their control applicable to the matters and things in controversy, and also to examine, on oath, all witnesses the parties respectively may call before him, and to summon before him such witnesses residing in the district as the parties respectively may desire summoned, and to order the examination of any witnesses residing out of the district under a commission to be issued on his certificate by the clerk of this court, and generally to do and perform all things and make all inquiries and take all such proceedings as he may deem necessary and proper to the justice and merits and the rights of the parties; and the said special master will report severally on the said petitions, and until

said special master shall have made his reports or either of them all further orders and directions are reserved.

April 19th, 1889.

JOHN BRUCE, *Judge.*

24 Endorsed: "Filed April 19th, 1889. A. W. McCullough, clerk."

25 *Answer to Petition of Gordon, Strobel and Lareau.*

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY and Another.

Answer to petition and intervention of Gordon, Strobel and Lareau.

The joint and several answers of the Central Trust Company of New York, the Sheffield and Birmingham Coal, Iron and Railway Company, and J. G. Chamberlain, receiver, and C. D. Woodson to the foregoing petition and intervention of Gordon, Stroubel and Lareau, Limited.

To the honorable judges of the circuit court of the United States sitting at Huntsville, for the northern division of the northern district of the State of Alabama:

These respondents come and admit the consolidation of the said company of the 25th August, 1887, as is set forth in the petition and intervention above stated, but demand strict proof of every other matter and thing set forth and alleged in said petition whereby the claim or lien of said petitioners is sought to be established, and for their answer to the said petition and intervention aver and show to the court:

First. That said Gordon, Stroubel and Lareau, through Frederic W. Gordon, the senior member and partner of said firm, undertook to supervise and superintend the blowing in of one of the three furnaces of the Sheffield and Birmingham Coal, Iron and R'y Co., at Sheffield, known as "A" or No. 1, on the 17th day of

26 August, 1888, and that said blowing in, management, custody, and control of said furnace was put in charge of said Gordon, who continued in such management and control for the space of nine (9) days, during which time about one hundred and six (106) tons of pig-iron were made at said furnace, and then, said furnace being totally ruined and disabled, said Gordon himself abandoned said furnace and advised the executive officers of the Sheffield and Birmingham Coal, Iron and Railway Company that he could do nothing with it; that during the time said furnace was so under the management and control of said Gordon *that* he became totally incapacitated properly to manage said furnace, even if he at any time was competent to do so, and that by reason of said incapacity and incompetency of said Gordon not only was said furnace totally

ruined for all purposes of being operated or of making iron, *so* that said furnace had to be shoveled out, the hearth taken out, the bosh in part taken out, and the furnace repaired at a large outlay of time and money.

That by reason of the conduct of said Gordon and the ruining of said furnace your respondent, The Sheffield and Birmingham Coal, Iron and Railway Company, was damaged, in money and reputation, to the amount of at least $100,000 or other large sum.

That in addition to such damage the said Sheffield and Birmingham Coal, Iron and Railway Company laid out and expended in repairing said furnace "A," including labor and material, the sum of five thousand one hundred forty-two and $\frac{87}{100}$ dollars.

That the iron made by said furnace during the superintendency of said F. W. Gordon cost said Sheffield and Birmingham Coal, Iron and Railway Company the sum of sixty and $\frac{90}{100}$ ($60.90) dollars per ton, when, by proper care and management, it should not have exceeded twelve ($12) dollars per ton, thus occasioning a loss to said Sheffield and Birmingham Coal, Iron and Railway Company of over $5,000.00.

27 Second. That after said F. W. Gordon had so ruined furnace "A" he then proceeded to blow in furnace " B " or No. 2, beginning the same on the 7th day of September, 1888, and that after said Gordon had remained so in control and management of said furnace " B " for 16 days and had made about 700 tons of pig-iron, at a cost of about ($20) dollars per ton of said pig-iron, he, by his carelessness, mismanagement, and incompetency, put said furnace in such a condition that it was apparent to the executive officers of said Sheffield and Birmingham Coal, Iron and Railway Company that said furnace " B " would also be ruined in the same way as was furnace "A" if said Gordon remained longer in control and management of it, and he was, therefore, asked to relinquish the control of said furnace " B," which he did on the 22 day of Sept., 1888.

That after said Sheffield and Birmingham Coal, Iron and Railway Company, through its own officials, took charge and management of said furnace " B " it began to improve and, by great care and attention, was brought around and has been in operation ever since; and your respondents aver that at the time the Sheffield and Birmingham Coal, Iron and Railway Company took charge of said furnace " B " it had been greatly injured and damaged by the management of said Gordon, so that it became necessary to treat it with great care and attention and to lay out and expend a large amount of money upon it in order to prevent it also from being ruined, and it thus required about six weeks to get said furnace in a good condition, its hearths having been filled up and it being otherwise damaged and disabled; and the respondents aver that the loss accruing to said Sheffield and Birmingham Coal, Iron and Railway Company by the aforesaid management of Gordon of furnace " B " amounted to about the sum of ten thousand ($10,000) dollars, this amount being made up of the decrease of the output of iron

28 and expenditures in labor and material in bringing said furnace to a proper working condition.

Third. Respondents aver that said three furnaces and the plant and buildings connected therewith, so constructed by said Gordon, Strobel and Lareau under said contract referred to and set forth in the aforesaid petition and intervention, were not built and constructed according to the plans and specifications, agreements, and undertakings set forth in said contract in various ways, as follows, to wit:

(A.) There should have been a system of valves from the boilers to the engine, so that any of said boilers or any engine could be shut off from the balance, thus giving an opportunity to repair the pipes and fix the steam joints, but as the furnaces were really constructed no steam joints or pipes can be repaired in any way between the valves at the boilers and the valves at the engines without stopping the engines and the furnaces and also stopping all pumps, and that this defect had been noticed and called attention to by an expert in such matters, namely, a Mr. Best, of the firm of Best, Fox and Co., of Pittsburgh, Pa., at the time said furnaces were being constructed, and that notwithstanding such attention being called to the faulty and defective construction by Mr. Best that the said contractors, Gordon, Strobel and Lareau, had persisted in building the furnaces as they did.

Respondents aver that in order to make the necessary changes in said system of valves, pipes, *ect.*, would require about $1,500.

(B.) Respondents aver that by reason of said faulty and defective construction of said furnaces it became necessary to have an independent steam pipe from the boilers to the pumps in order to keep the pumps in operation while the joints and pipes were being repaired. This work would cost about six hundred (600) dol-
29 lars, including work on the boilers caused by set-ling of the foundations.

(C.) Respondents aver that by reason of the faulty and improper construction of said furnaces there is no valve in the main water-supply pipe to the feed-pumps with which to shut the water from the pumps in case the valves near the pumps should fail to work, which often happens.

And that to put in this valve, were no furnace in blast, would cost about the sum of fifty ($50) dollars; but to stop the furnaces and take out the tuyeres and water-coolers so that the water could be shut off from the furnaces and valves be put in would cause, in all probability, the stoppage of the furnace for two or three days and nights, and thereby occasion loss and damage in labor, material, and money to the extent of at least one thousand ($1,000) dollars.

(D.) Respondents further aver that the stock-houses erected for said furnaces is totally inadequate, having only a capacity for two furnaces instead of three, and thus a large amount of material, consisting of ore, coke, and limestone, has to be put outside of the stock-house, where it is exposed to the weather and where it has to be handled, in order to get it into the furnace, at great disadvantage and loss, and that this defect cannot be remedied except by making the stock-house at least three hundred feet longer and 30 ft. wider

than it now is, which necessary improvement could not be done for less than about $10,000.

(E.) Respondents further aver and show to the court that the outlet of pipes leading from the stoves to the furnaces should be connected and supplied with a system of valves, so that any one set of stoves (there being three sets to each furnace) could be used on either furnace, and that this defect, which is a very radical one, could not be remedied for less than an outlay and cost of about twenty-five hundred ($2,500) dollars.

30 (F.) Respondents further aver and show to the court that there should have been a bridge connecting all of the furnaces and stoves, so that in case anything happened to any one hoisting engine that the furnaces could have been kept going by filling from any other of the hoisting towers not directly connected with said furnace, and also to get easy access to all the hot-blast stoves, and that this necessary improvement and addition could not be made for less than about two thousand ($2,000) dollars.

(G.) Respondents further aver and show to the court that the boiler power supplied by said furnace boilers is totally inadequate to run three furnaces at once, but is only about sufficient for the operation of two furnaces at the same time, and that to render said boilers sufficient would require the putting in of three more batteries of two boilers in each battery, as they now are, and that the officials of said Sheffield and Birmingham Coal, Iron and Railway Company have taken careful estimates of what it would cost to remedy this very great defect in boiler power, and find that it would cost, in order to have sufficient boiler power to run three furnaces at once, about the sum of $25,000.

(H.) Respondents further aver and show to the court that the foundations for the boilers have settled in the centre, causing trouble and expense already, by reason of such settling, and showing that the foundations were not prepared with sufficient strength nor properly constructed.

(I.) Respondents further aver and show to the court that all three of the furnaces, as constructed by Gordon, Strobel and Lareau, were very poorly banded; that the he-rth and lower part of bosh expanded, and the furnace will not run nearly so long as if it had been well banded at first; that the brick-work in the he-rth was carelessly and improperly executed, and, in many instances, so poor was this work that it was clearly apparent to the most superficial observation that it was performed in the most unworkmanlike and careless manner.

31

(J.) Respondents further aver and show to the court that the coping stones about the foundations of the casting-houses, where there are openings of small stones, when there should have been stones of the full width of the wall and the full length of the opening — not less than one foot in thickness, and that by reason of such faulty construction the walls have already commenced to give away, and it has become necessary to make cast plates to put in to prevent the walls from further disintegration and falling to pieces.

(K.) Respondents further aver and show to the court that the blast

engines are too light to run up to the speed they should do in order to bring the furnace up to its best capacity and output, and that they will not stand and enable the furnace to be put up to its best work; that already one of the piston heads of the blast cylinder in one of the engines has broken and that one of the bed plates has also broken, demonstrating that they were too weak or were erected on bad foundations. Further, that it requires constantly two engines to run one furnace, and should all three furnaces be put in blast (after the boiler power should be so increased as to render that possible), then there would be only one spare engine, which would not be sufficient, of the kind and class of engines so erected at these furnaces to make it safe to operate all three furnaces at once, and that to remedy this defect there should be eight blast engines instead of seven, and that such additional engine should weigh not less than 190,000 lbs. instead of about 160,000 lbs., as is the weight of each of the seven engines now constructed. Respondents aver that the officials of the said Sheffield and Birmingham Coal, Iron and
32 Railway Company have caused estimates to be made of the cost to put in another engine as aforesaid, and that such engine could not be put up at a less outlay than $12,000; and respondents further aver in this connection that the officials have been informed by Wm. Todd & Co., of Youngstown, Ohio, manufacturers of blast engines, that Gordon, Strobel and Lareau or some member of that firm approached said Wm. Todd & Co. during the construction of said furnaces to furnish the blast engines such as were used and are now in operation at said furnaces, and that said Todd & Co. refused to take the contract to furnish said engines from the patterns submitted by said Gordon, Strobel and Lareau, because they would be too light for the work expected of them and inadequate to operate the furnaces successfully; but that notwithstanding being so put upon notice that the engines, such as were used, were not adequate for the purpose for which they were erected, yet said Gordon, Strobel and Lareau procured engines elsewhere and erected them at said furnaces.

Fourth. Respondents specially deny that the item of $9,618.16, set forth and charged in the bill of petitioners as "freight excess payments, as per 15½ clause contract," is any lien or charge upon said three furnaces or the ground on which they are situated.

And respondents also specially deny that the item of $1,194.50, set forth and charged in the bill of petitioners as "extra material furnished Sept. 21, Oct. 16, and Oct. 29, 1888, as per Nov. 1st statement," is any lien or charge upon said three furnaces or the ground on which they are situated.

Wherefore these respondents pray the honorable court that this answer may be taken as a cross-petition and intervention in the nature of a cross-bill in equity, and that the court will refer the original petition and this answer to a master in chancery to take evidence and report upon the same, or that the court will pass
33 upon the same as it may deem proper, and that, upon the coming in of the proofs, the court will proceed and decree that the said Gordon, Strobel and Lareau have neither any claim

or lien of any kind or character whatsoever against the said three furnaces and the grounds upon which they are situated at Sheffield, of the said Sheffield and Birmingham Coal, Iron and Railway Company; that the court will then further decree against said Gordon, Strobel and Lareau such amount as shall be found to be due said Sheffield and Birmingham Coal, Iron and Railway Company under the pleadings and proofs of this intervention and petition, and that the court pass such further orders, judgments, and decrees in the cause as shall be meet and equitable.

BUTLER, STILLMAN AND HUBBARD,
*Sol's for Central Trust Company of New York.*
HENRY B. TOMPKINS, *Of Counsel.*
LAWRENCE COOPER,
*Sol. for S. & B. C., I. & R'y Co.*
J. G. CHAMBERLAIN, *Receiver.*

Endorsed: "Filed in clerk's office this 23rd day of April, 1889. A. W. McCullough, clerk."

34 *In Re* Intervention of GORDON, STROBEL & LAREAU, Limited.

*Amended Answer of Respondents.*

In the United States Circuit Court for Northern District and Northern Division of Alabama.

CENTRAL TRUST COMPANY OF N. Y.
*vs.*
SHEFFIELD & BIRMINGHAM COAL, IRON AND RAILWAY COMPANY and Another.

*In re* petition and intervention of Gordon, Strobel and Labeau, Limited.

And now come the respondents in the above-stated intervention, Central Trust Company of N. Y. and another, and, by leave of the court first had, amend their answer, &c., to the said intervention and say—

1. That upon information and belief and from knowledge that has lately come to them they aver that Gordon, Strobel and Lareau, Limited, is an incorporated company, organized under the laws and statutes of the State of Pennsylvania, and is so a corporation foreign to the State of Alabama.

2. That the proposition of intervenors to construct the three furnaces was made on 9 February, and was accepted by the Alabama & Tenn. C. & I. Co. some time thereafter and about 1st March, 1887.

3. Respondents also allege that said corporation of Gordon, Strobel and Lareau, Limited, have failed to comply with the constitu-
35 tutional statutes of the State of Alabama by filing with the secretary of State of Alabama the statements in writing as to

its incorporation and place of business in Alabama, and have especially failed and refused to comply with the provisions of the act of the General Assembly of Alabama of — day of February, 1887.

Wherefore respondents pray as heretofore in this answer and cross-bill, and also that the intervention of said Gordon, Stroubel and Lareau, Limited, be proceeded with no further, but the same be dismissed.

BUTLER, STILLMAN AND HUBBARD,
*Sol's for Central Trust Co. of New York.*

HENRY B. TOMPKINS,
J. M. WHITE, *Of Counsel.*

This amendment being submitted by the solicitor for the respondents, Central Trust Company of New York and -other, the court, after argument, ordered that the amendment be not allowed to be filed; to which ruling solicitors excepted.

June 12th, 1890.

DON A. PARDEE, *Judge.*

36 *In Re* Intervention of GORDON, STROUBEL and LAREAU.

*Amendment of Answer of Respondent.*

In the Circuit Court of the United States for the Northern District and Division of Alabama, at Huntsville.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY and Another.

*In re* petition and intervention of Gordon, Stroubel and Lareau.

*Amendment to the Answer and Cross-Bill of Respondents.*

Respondents, by leave of the court first had and obtained, come and amend their petition and cross-bill and say that said furnace plant so erected by Gordon, Stroubel and Lareau for the Sheffield and Birmingham Coal, Iron and Railway Company, consisting of three furnaces, was constructed in so faulty, inadequate, and improper a manner that, unlike the two other furnaces at Sheffield and other furnaces properly constructed elsewhere, said furnace plant of thre- furnaces could not be operated so as to make steam by consuming the gases under the boilers, as is ordinarily done in modern furnaces of approved pattern and construction, but that it became necessary in order to make steam for said furnaces, or for one of said furnaces while in operation, to consume from 350 to 500 pounds of coal to each ton of iron made at said furnace, so that each ton of iron so made cost from forty to fifty cents more than it ought to have cost per ton, and thus averaged in the daily expence

account for operating each of said furnace- over $50 per day
37 more than would have been the case if said Gordon, Stroubel and Lareau had properly constructed said furnaces.

And respondents aver and show to the court that by the evidence adduced at the hearing before the special master in chancery that after running one furnace twelve months it has been practically demonstrated that it cost over $20,000 more to operate said furnace-per annum than it would have cost if said furnaces had been properly constructed so as to have saved said consumption of coal under the boilers.

CENTRAL TRUST COMPANY OF N. Y.,
By BUTLER, STILLMAN AND HUBBARD, *Sol's.*

SHEFFIELD AND BIRMINGHAM COAL,
IRON AND RAILWAY COMPANY,
By LAWRENCE COOPER, *Sol.*
J. G. CHAMBERLAIN, *Receiver.*

Endorsed: "Filed in clerk's office this —."

38 STATE OF TENNESSEE, }
*Shelby County.* }

Before me, the undersigned, a notary public in and for said State and county, personally came Enoch Ensley, who, being first and duly sworn, on oath says:

I have for a number of years been engaged in the coal and iron business in the State of Alabama, at Birmingham, and latterly at Sheffield; was once president of the Tennessee Coal, Iron and R'y Co., which owns the Pratt coking coal mines and a large number of furnaces in Tennessee and Alabama and other valuable minerals, and have thus had large and varied experience in iron-making, and have knowledge of blast furnaces and how they should be constructed and equipped. I am the owner of one blast furnace at Sheffield, Alabama, called the Hattie Ensley furnace, and am the majority owner of another furnace at Sheffield, called the Lady Ensley furnace, at which place, to wit, Sheffield, Alabama, very close to the two furnaces mentioned, are situated the three furnaces of the Sheffield and Birmingham Coal, Iron and Railway Company. After acquiring the furnace property above mentioned, at Sheffield, by reason of my knowledge of furnaces I would not permit them to go into blast until the boiler power, which was similar and about equal to the boiler power of the three furnaces of the Sheffield and Birmingham Coal, Iron and Railway Company, had been very largely added to and increased, deeming that the furnaces could not be properly, successfully, or advantageously run without increasing the boiler power about fifty per cent. over and above what it was when I acquired my interest in said two furnaces. From what I know of the boiler power of the three furnaces of the Sheffield and Birmingham Coal, Iron and Railway Company it is totally deficient

and inadequate for the successful operation of said three fur-
39 naces, and, in my opinion, it will require at least 50 per cent. additional boilers to render said furnaces in a condition for all three of them to be operated at once, and this additional boiler power to said three furnaces could not be made for a less outlay than —— thousand dollars.

From what I know of said three furnaces they are useless as a property to be operated all three at once without an additional expenditure, as above stated, upon the boiler power alone, and in my opinion the engines are not of such construction and efficiency as would enable the three furnaces to be operated all together, even if the boiler power was made adequate, as above stated.

ENOCH ENSLEY.

Sworn to and subscribed to before me this the 12th day of June, 1890.

J. P. YOUNG,
*Notary Public.*

Endorsed: "Filed June the 12th, 1890, on the hearing, but on motion of intervenors ordered suppressed as evidence. Don A. Pardee, judge."

40 In the United States Circuit Court at Huntsville, Ala. In Equity.

CENTRAL TRUST COMPANY
*vs.*
SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY. } No. 150.

In the matter of the intervention of Gordon, Strobel and Lareau, Limited.

The special master having made his report in the above intervention and exceptions being filed thereto, and the term of the court at which said exceptions might have been heard having passed without hearing the same, upon an agreement of counsel that the cause might be submitted thereon and heard at Chambers before Hon. Don A. Pardee, now, it is hereby agreed that the said judge may hear said exceptions in all respects as in term time and his decree thereon shall be considered and taken for all purposes as rendered in term time.

R. C. BRICKELL &
W. A. GUNTER,
*For Gordon, Stroubel & Lareau.*

BUTLER, STILLMAN & HUBBARD,
HENRY B. TOMPKINS,
LAWRENCE COOPER & J. M. WHITE,
*For Exceptors.*

Endorsed: "Filed June 12th, 1890. Don A. Pardee, judge."

account for operating each of said furnace- over $50 per day
37 more than would have been the case if said Gordon, Stroubel and Lareau had properly constructed said furnaces.

And respondents aver and show to the court that by the evidence adduced at the hearing before the special master in chancery that after running one furnace twelve months it has been practically demonstrated that it cost over $20,000 more to operate said furnace-per annum than it would have cost if said furnaces had been properly constructed so as to have saved said consumption of coal under the boilers.

CENTRAL TRUST COMPANY OF N. Y.,
By BUTLER, STILLMAN AND HUBBARD, *Sol's.*

SHEFFIELD AND BIRMINGHAM COAL,
IRON AND RAILWAY COMPANY,
By LAWRENCE COOPER, *Sol.*
J. G. CHAMBERLAIN, *Receiver.*

Endorsed: "Filed in clerk's office this —."

38 STATE OF TENNESSEE, }
*Shelby County.* }

Before me, the undersigned, a notary public in and for said State and county, personally came Enoch Ensley, who, being first and duly sworn, on oath says:

I have for a number of years been engaged in the coal and iron business in the State of Alabama, at Birmingham, and latterly at Sheffield; was once president of the Tennessee Coal, Iron and R'y Co., which owns the Pratt coking coal mines and a large number of furnaces in Tennessee and Alabama and other valuable minerals, and have thus had large and varied experience in iron-making, and have knowledge of blast furnaces and how they should be constructed and equipped. I am the owner of one blast furnace at Sheffield, Alabama, called the Hattie Ensley furnace, and am the majority owner of another furnace at Sheffield, called the Lady Ensley furnace, at which place, to wit, Sheffield, Alabama, very close to the two furnaces mentioned, are situated the three furnaces of the Sheffield and Birmingham Coal, Iron and Railway Company. After acquiring the furnace property above mentioned, at Sheffield, by reason of my knowledge of furnaces I would not permit them to go into blast until the boiler power, which was similar and about equal to the boiler power of the three furnaces of the Sheffield and Birmingham Coal, Iron and Railway Company, had been very largely added to and increased, deeming that the furnaces could not be properly, successfully, or advantageously run without increasing the boiler power about fifty per cent. over and above what it was when I acquired my interest in said two furnaces. From what I know of the boiler power of the three furnaces of the Sheffield and Birmingham Coal, Iron and Railway Company it is totally deficient

and inadequate for the successful operation of said three fur-
39 naces, and, in my opinion, it will require at least 50 per cent. additional boilers to render said furnaces in a condition for all three of them to be operated at once, and this additional boiler power to said three furnaces could not be made for a less outlay than —— thousand dollars.

From what I know of said three furnaces they are useless as a property to be operated all three at once without an additional expenditure, as above stated, upon the boiler power alone, and in my opinion the engines are not of such construction and efficiency as would enable the three furnaces to be operated all together, even if the boiler power was made adequate, as above stated.

ENOCH ENSLEY.

Sworn to and subscribed to before me this the 12th day of June, 1890.

J. P. YOUNG,
*Notary Public.*

Endorsed: "Filed June the 12th, 1890, on the hearing, but on motion of intervenors ordered suppressed as evidence. Don A. Pardee, judge."

40 In the United States Circuit Court at Huntsville, Ala. In Equity.

CENTRAL TRUST COMPANY
*vs.*
SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY. } No. 150.

In the matter of the intervention of Gordon, Strobel and Lareau, Limited.

The special master having made his report in the above intervention and exceptions being filed thereto, and the term of the court at which said exceptions might have been heard having passed without hearing the same, upon an agreement of counsel that the cause might be submitted thereon and heard at Chambers before Hon. Don A. Pardee, now, it is hereby agreed that the said judge may hear said exceptions in all respects as in term time and his decree thereon shall be considered and taken for all purposes as rendered in term time.

R. C. BRICKELL &
W. A. GUNTER,
*For Gordon, Stroubel & Lareau.*

BUTLER, STILLMAN & HUBBARD,
HENRY B. TOMPKINS,
LAWRENCE COOPER & J. M. WHITE,
*For Exceptors.*

Endorsed: "Filed June 12th, 1890. Don A. Pardee, judge."

41 *In re* Intervention of GORDON, STROBEL and LAREAU.

*Report of Special Master.*

In the Circuit Court of the United States for the Northern District of Alabama, Northern Division.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD & BIRMINGHAM COAL, IRON AND RAILWAY COMPANY.

*In re* intervention of Gordon, Stroubel & Lareau, Limited.

To the honorable judges of said court:

The undersigned as special master makes the following report:

On the 9th day of February, 1887, the intervenors made a contract with the Alabama and Tennessee Coal & Iron Company for the construction, at Sheffield, Alabama, of three blast furnaces. The contract included specifications describing in detail the work to be done. The work was to be done "in a good and workman-like manner and of suitable material, and each part to be adequate in design, strength, capacity, and workmanship for the purpose for which it was intended." It was also agreed that the superintendant of the Alabama & Tennessee Coal & Iron Company should pass upon the work every two weeks, and, if to his satisfaction, it was to be a final acceptance of the work so far as done. The agreed price of the work was to be $564,000. The evidence shows without conflict that Edward Doud, who was the superintendant of the company, made inspections and supervised the work and caused changes to be made in the work from time to time and accepted it when, in his judgment, it was in compliance with the contract. Payments, by the terms of the contract, were to be made on the 15th of each month on a basis of ninety per cent. of the value of all the materials delivered and the value of the work executed thereon, except the blowing engines, upon which ninety per cent. on their valuation was to be paid according to their advancement in the shop. The payments were made on the report of the superintendant as the work progressed, and, including some payments of excess in freights to be hereafter considered, amounted to $514,500. While the work was in progress the Alabama and Tennessee Coal and Iron Company was consolidated with the Sheffield and Birmingham Coal, Iron and Railway Company, the latter becoming responsible on the contract, and the superintendant, Mr. Edward Doud, acting for the latter company, continued to supervise the work. The contractors claimed to have finished the work on the 8th of August, 1888, and requested its final acceptance. Mr. E. W. Cole, as president of the Sheffield and Birmingham Coal, Iron and Railway Company, to whom application was made, referred the matter of final acceptance to Mr. Edward Doud, the superintendent, by a telegram date- August 17th, 1888. Mr. Doud, on the 18th of August, in writing, accepted the plant as completed according to the terms of the contract. On the 18th of January,

42

1889, a verified statement of the amount claimed to be due on this contract was filed with the judge of probate of Colbert county in substantial conformity with section 3022 of the Code of Alabama of 1886, which provides the manner in which to secure the liens of mechanics and material men declared by section 3018 of the same code. The purpose of the intervention is to enforce this lien and to collect the remainder claimed to be due on the contract.

43 A large number of depositions have been taken in the case, all of which I have considered carefully, and I have come to the conclusion that the defenses set up by the defendants are not sustained by the evidence, and that the petitioners, Gordon, Stroubel and Lareau, are entitled to be paid the contract price for their work and material.

The accepted proposition contained this stipulation: "We have based our estimates on a freight rate of 13½ cents per hundred pounds from Cincinnati, Ohio, to the site of construction, which rate is to be guaranteed and made good by you." The petitioners insist that the proper construction of the contract makes a guarantee that the charges from any point in Cincinnati shall not exceed 13½ cents; that including transfer charges from one depot to another the rate from Cincinnati to the site of construction shall be only 13½ cents per hundred pounds. The defendant, on the contrary, claims that the guaranty is as to the freight where the goods are shipped from Cincinnati to the site of construction, and that it is not a guaranty that the transfer charges and freight together shall not exceed 13½ cents per 100 pounds.

The expression used in the contract is "a freight rate" and "from Cincinnati." It is not a freight rate and transfer charges. It is not reasonable to suppose that either party to the contract had in contemplation the transfer charges in Cincinnati.

In Owen *vs.* Railroad Company, 25 Am. & Eng. R. R. Cases, 371, it was held in effect that the word freight in a statute against excessive freights does not include transfer charges from the elevator to the depot nor from one depot to another. I do not think that the transfer charges in Cincinnati are embraced by the terms of the contract. Excluding the transfer charges in Cincinnati, the evidence shows that the petitioners paid as freight in excess of

44 the rates guaranteed $7,113.62, and that they have been reimbursed to the extent of $6,900, leaving due them $213.62 on account of freight.

The work having been completed and accepted August 18th, 1888, the unpaid balance by the contract was to be partly paid and partly secured within thirty days after the work was finished by notes bearing six per cent. interest. As the defendant did not give the notes on request, the balance found due should, I think, bear interest at the rate of 8 per cent., the legal rate, after the expiration of thirty days from August 18th, 1888. Stating the account to conform to this report, I find that there is due the petitioners Gordon, Strobel and Lareau, including the excess of freights and extra ma-

terial furnished, the sum of $57,808.12, with interest to be added from September 18th, 1888.

I also report that under the statutes referred to that the intervenors have a lien on the property described in their petition. I attach as an exhibit to this report a statement of the account.

Respectfully submitted.

D. D. SHELBY,
*Special Master.*

45 The Sheffield and Birmingham Coal, Iron and Railway Company, successors to the Alabama and Tennessee Coal and Iron Company, to Gordon, Strobel and Lareau, Limited, Dr.

| | | |
|---|---|---|
| To total contract amount | | $564,000 |
| " freight excess payments as per contract | | 7,113 62 |
| " extra material furnished Sept. 21, Oct. 16, Oct. 29, 1888, as per statement Nov. 1, 1888 | | 1,194 50 |
| | | $572,308 12 |

Cr.

| | |
|---|---|
| By payment on contract to date, Jan. 18, 1889 | $507,600 00 |
| " payment on excess of freights | 6,900 00 |
| | $514,500 00 |

$572,308 12
514,500 00

Balance due $57,808 12 Interest to be added from Sept. 18th, 1888.

46 Endorsed: "Filed in clerk's office this 25th day of February, 1890. A. W. McCullough, clerk."

47 *Exceptions to Report of Special Master on Intervention of G., S. & L.*

In the Circuit Court of the United States for the Northern District of the Northern Division of Alabama.

THE CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
THE SHEFFIELD & BIRMINGHAM COAL, IRON AND RAILWAY COMPANY *et als.* } In Equity

Exceptions filed by the Sheffield and Birmingham Coal, Iron and Railway Company, The Central Trust Company of New York, and Jacob G. Chamberlain, receiver, to the report of the special master *in re* the intervention of Gordon, Stroubel and Lareau.

To the honorable judges of said court:

The Sheffield and Birmingham Coal, Iron and Railway Company, The Central Trust Company of New York, and Jacob G. Chamberlain

receiver, defendants, to the petition of Gordon, Strobel and Lareau, filed *in re* said invention, not waiving any right that they may have, jointly or separately, to have the proceedings instituted by intervenors dismissed out of this court for want of jurisdiction in this court to enforce such lien, except to so much and such parts of the report filed in this court on the 25th day of February, 1890, by the special master, D. D. Shelby, Esq., as are below specially assigned, and for the reasons below stated. Defendants except to so much of said report and the findings of the master in reference thereto as determines—

(1.) "That the defenses set up by the defendants are not sustained by the evidence."

(2.) "That the petitioners, Gordon, Stroubel and Lareau, are entitled to be paid the contract price for their work and material."

48 (3.) "That the sum of $57,808.12, with interest from the 18th of September, 1888, is the amount due the intervenors;" and,

(4.) "That intervenors have a lien on the property described in their petition; and for grounds or reasons for such exceptions they assign the following:

1st. Because the evidence in the case sustained the defenses set up by the defendants and showed, 2nd, that the work and materials done and furnished by intervenors were not up to the requirement and guaranty of their contract, by reason of which the value of the plant as built and equipped was worth sixty or seventy-five thousand dollars less than the contract price; and, 3rd, because such report is contrary to the weight of testimony on each of the matters so reported.

Defendants here note the evidence or parts of evidence they rely on in support of these exceptions, the same being depositions taken and filed in said matter by special master:

| | | | | | |
|---|---|---|---|---|---|
| Depositions of | J. G. Chamberlain, | Exhibit | "A," | page | 1 to 24. |
| " | " G. W. Killerbrew, | " | " | " | 16 to 18. |
| " | " Alex. McIlwain, | " | " | " | 18 to 23. |
| " | " Henry Brown, | " | " | " | 25 to 27. |
| " | " J. H. Partlow, | " | B, | " | 1 to 3. |
| " | " J. H. Murphy, | " | " | " | 1 to 3. |
| " | " George Lyell, | " | C, | " | 1 to 3. |
| " | " Alex. McIlwain | " | D, | " | 1 to 6. |
| " | " J. G. Chamberlain, | " | E, | " | 1 to 3. |
| " | " Fred. Massy, | " | F, | " | 1 to 3. |
| " | " " " | " | G, | " | 1 to 5. |
| " | " " " | " | G, | " | 17 to 20. |
| " | " H. B. Tompkins, | " | H, | " | 1 to 4. |

49 They respectfully submit these exceptions and ask that they be heard and considered, and that the said report of the

special master be reformed on the points excepted to so as to conform to the equity and justice of the case.

BUTLER, STILLMAN AND HUBBARD,
HENRY B. TOMPKINS,
LAWRENCE COOPER, &
ROQUEMORE, WHITE & McKENZIE,
*Attorneys for Defendants.*

Endorsed: "Filed in clerk's office March 17th, 1890. A. W. McCullough, clerk."

50 *Decree of Judge Pardee on Intervention of G., S. & Lr.*

Circuit Court of the United States for the Northern District of Alabama, Northern Division.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
THE SHEFFIELD, BIRMINGHAM COAL, IRON AND RAILWAY COMPANY. } In Equity.

Intervention of Gordon, Strobel & Lareau on exceptions to master's report.

This cause came on to be heard, as by agreement of counsel on file, on the exceptions to the master's report and was argued.

Whereupon, it appearing that the acceptance of the work bi-weekly as it progressed and as a whole on completion by the defendant's superintendant in accordance with the terms of the contract is conclusive upon the defendant that the work contracted for was done and performed in accordance with the specifications, and that in the said contract the intervenors did not guarantee that the work or plant as a whole was adequate in design, strength, and capacity for any purpose intended and specified, it is ordered, adjudged, and decreed that the exceptions to the master's report be, and the same are hereby, over-uled, and that the said report be, and the same is hereby, confirmed.

It is further ordered, adjudged, and decreed that the inter-
51 venors, Gordon, Strouble and Lareau, do have and recover of the defendant The Sheffield & Birmingham Coal, Iron and Railway Company, as recommended in said master's report, the sum of fifty-seven thousand eight hundred and eight and twelve one-hundreths dollars ($57,808.12), with interest thereon at six per cent. per annum from the 18th day of December, 1888, until paid, and all costs of this intervention, to be taxed, and that the mechanics' lien as given by the laws of the State of Alabama and claimed and set forth in the intervention on file be, and the same is hereby, fully recognized and allowed as being a subsisting first lien upon the property specifically described in said intervention and exhibits.

And whereas the said property, which at the time of the filing of the intervention in this cause was in the possession of this court,

has been since sold, conveyed, and delivered under a decree rendered in this cause, but subject to whatever lien or claim might be allowed in this cause, it is further ordered, adjudged, and decreed that the said purchasers of said property do pay the aforesaid judgment of fifty-seven thousand eight hundred and eight and twelve one-hundreth dollars ($57,808.12), with interest as aforesaid, and all costs as aforesaid within twenty days after the filing of this decree, and that in default thereof an order for the resale of said property for the satisfaction of the judgment aforesaid may issue.

Decree rendered and signed this 24th day of June, 1890.

DON A. PARDEE,
*Circuit Judge.*

Endorsed: "Filed in clerk's office this 26th day of June, A. D. 1890. A. W. McCullough, clerk."

52 United States Circuit Court, Northern District of Alabama, Northern Division.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
THE SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY COMPANY. } In Equity.

Intervention of Gordon, Strobel & Lareau.

The decree rendered and signed in this case on the 24th day of June, 1890, containing errors as to rate of interest and date from which interest should begin to run, it is now ordered, adjudged, and decreed that the said decree be amended so as to provide that interest on the sum of $57,803.12 shall begin to run from the 18th day of September instead of the 18th day of December as mentioned in said decree, and that the rate on interest shall be at eight (8) per cent. per annum instead of six per cent. per annum.

June 30th, 1890.

DON A. PARDEE,
*Circuit Judge.*

Filed in clerk's office July 2nd, 1890.
A. W. McCULLOUGH, *Clerk.*

53 *Proofs Introduced at the Hearing Before the Special Master in Chancery.*

54 Specifications.

Three (3) 18 x 75 feet blast furnaces.

(For the Alabama and Tennessee Coal and Iron Co.)

Foundation plates.—The furnace will commence on the foundation with a cast circle foundation plate 3 & ¾ in. thick and 30 inches wide, made in 8 sections, strongly linked together. A bearing on each of these sections will be planed off to receive a column.

Columns.—There will be eight columns placed in a circle of 22″ feet in diameter, each column being 18″ in diameter at the base and 16″ at the top and 18 feet in height, with strong capital and foundation flanges. Each end of these columns will be accurately machined.

Column brackets.—On top of each column will be bolted a bracket 75″ high of T-form bracing. The base will be machined to rest accurately on the top of the column and a heavy inside top flange will be riveted to the wrought mantel plate and the wrought bosh plate.

Staying.—Staying each of these brackets in rigid radial form will be bolted 8″ x 1″ bars forming a circle around the furnace.

Bosh plate.—The bosh jacket commences at the bottom of these brackets 11 feet in height from the hearth, and will extend to the wrought mantle. It will be 15 lbs. in thickness and be riveted in the perpendicular seams. It will be riveted on top to a 4″ x 4″ inch angle iron and this to the horizontal member of the mantel plate.

Mantel plate.—The mantel plate will be 18″ wide, and be composed of a horizontal wrought-iron plate 20 lbs. thick, entirely surrounding the furnace, the ends of the sections comprising it being butt-jointed together with heavy strap plates which will be triple-riveted. On each edge will be 4″ x 4″ angle iron, the outer one being riveted to the shell proper and the inner one to the bosh jacket. An eye beam 12″ high & of 180 lbs. per yard will extend from the center of one column bracket to the other and be riveted to the horizontal member of the mantel plate.

Furnace shell.—The furnace shell will be 23′ in diameter at the bottom, commencing at the mantel with plate iron $\frac{5}{16}$″ thick and end at the platform with plate iron $\frac{1}{4}$ in. thick. All the perpendicular seams will be double-riveted in the strongest manner, and all the horizontal seams will be closely single-riveted.

Platform.—On top of this shell 20′ 3″ in diam. there will be two angle irons, one outside being 2 & $\frac{1}{2}$″ x 3″, to which the overhanging platform plate will be riveted, and the other 2″ x 2 & $\frac{1}{2}$″, on which the cast inner platform plates will rest. The platform will have a diameter of 26′ 3″ and *and* be composed of 12 & $\frac{1}{2}$ in. plate iron, all its seams being butt-strapped and rivets driven counter-wunked to present a smooth surface to the charging barrow. This overhanged — will be supported by 11 cast brackets of strong and neat construction.

Bridge.—The bridge will be 15 ft. long and 17 ft. wide; plate iron $\frac{5}{16}$″ thick and butt-strapped. The bridge will be supported by three beams 15″ deep and 150 lbs. per yard. On each side of this bridge and all around the platform will be a guard 42″ high made of $\frac{1}{8}$ plate iron. On the top of this guard will be stiffened with an angle iron 1 & $\frac{1}{2}$ x 1 & $\frac{1}{2}$″.

The bell & hopper, lip ring, arch beams.—The bell and hopper and all the apparatus belonging to them will be carried from the furnace shell independently of the brick lining by 13 brackets upon

which will rest a circular cast-iron plate. Within this plate will be the hopper and on it will be bolted to properly machined surfaces the arch from which the bell is swung. The hopper will be 13′ 6″ in diameter and 38″ deep and 1 & ¼″ thick. In it will be fitted a lip ring keyed on a flange. This ring will be 1 & ½″ thick and 17″ long. Its lower edge will be turned off to fit the bell gas-tight. The arches spanning from side to side of the hopper ring will be two stands on each side spanned by two 15″ channel irons. One side of this will carry by a neatly fitting pin 3″ in diameter the wrought-iron beams supporting the bell; on the other side wrought beams will be jointed in a similar manner, carrying a counterwunk and supporting its —. To the former will be attached a steam cylinder by which the bell can be operated, whether the furnace has blast on or not. By this double-beam system a better distribution of the weights will be effected.

Bosh cooling plates.—Around the bosh of the furnace and built within the brick-work there will be three circles of air & water cooled plates, consisting of double cast-iron shell, within which is
56 clayed a water-cooled plate, projecting beyond them and within 5 inches of the inner ring of the furnace. The great advantage of this plan of construction over the old type is, 1st, the water-cooled portion can be examined at any time for leaks by simply driving in a bar at a short distance; 2nd, if found to leak it can be removed without tearing out the brick-work and with but a slight stop to the furnaces; 3rd, the air-cooled plates are always exposed to view, so that any approach of heat can be detected and beaten back by water spray.

Tuyere arches. Intermediate water plates.—There will be placed in the hearth 7 tuyere housens or arches made by closely circling double-thick gas pipes and by casting iron around it. These will be 27 inches long and 24 & ½ inches inside at butt and 21 inches wide at point. They will rest by wings provided upon them upon a system of air and water cooled plates, as above described, which will span from tuyere arch to tuyere arch all around and with the arches will form a continuous band encircling the furnace hearth.

Bands.—Above the water-tuyere housens and above each bosh cooling plate the furnace will be encircled by a wrought-iron band 7″ x ¾″. In each of these there will be tampering screws, whose least section under strain will be equal to the band. Two perpendicular struts are spaced between each tuyere housen, which will be riveted to each circular band.

Dam plates.—Below the tuyere housens there will be a shell of wrought iron ½″ thick with expanding slot holes. This shell will extend 3 feet below the bottom of the hearth. This will commence and end with the water-dam plate, which will be made especially strong to resist the pull caused by the hearth expanding. This dam plate will be provided with a false dry dam inserted conveniently within the water dam, lessening the possibility of accident, and by running the water-dam casting below the dry dam great strength is secured.

Water-cooled cinder notch.—At a convenient distance below the

tuyere centres we will place a water-cooled arch to hold the bronze water-cooled cinder tuyere made and secured for the readiest change and the greatest endurance.

Tuyeres.—In each of the tuyere housens will be placed a bronze tuyere 6″ diameter at the nose and 12″ long.

57 Bustle pipe.—Entirely surrounding the furnace columns and swung from the cast bosh brackets will be a bustle pipe. It will be made of plate iron $\frac{3}{16}$ inches in thickness, closely riveted and tightly caulked. This shell will be lined with carefully laid fire-brick to a clear internal diameter of 22″.

Blow-pipes.—To this pipe will be riveted 7 of our revolving blow-pipes (patented) with ball joints, carefully machined, and the lower section swung from a spring to provide for the varying expansion of the parts. A six-inch hole will be provided for claying tuyeres and this will be covered with a hinge plate provided with a neat snuffer hole and eyesight cover. The blow-pipe will be 15″ in diameter and will be lined with fire-brick to a clear way of 7 inches.

Water pipes.—The water necessary to cool the plates, tuyere housens, tuyeres, dam plates, cinder arch, and notch will be supplied from a circular water pipe 7 inches in diameter, from which it will be distributed by the best of fittings and three way cocks arranged to blow out these parts without disconnecting the piping.

Discharge pipes.—The water will then be discharged into a water trough 8″ x 8″ in surrounding the furnace, from whence the water will be conveyed to the sewer by a pipe 9″ in diameter.

Down-comer. Dust-catcher.—To carry away the gas from these furnaces we will construct one down-comer of 76″ in diameter of 8 lb. plate iron. On the bottom of this will be a circular dust-catcher 11 ft. 9 inches in diameter and 18 feet in height made of plate iron 8 lb. thick. It will have a conical top secured to the above down-comer and a conical bottom terminating with a bell and seat. This bell will be closed with a counter-weight. Through this bell the dust can be almost instantly withdrawn. On the end of the down-comer projecting through into the dust-catch chamber will be two deflecting plates 76″ in diameter to cause a settling of the dirt. From the top of the cylindrical portion of the dust-catcher two down pipes will carry the gas into the underground flues. Each of these will be 56″ in diameter. These serve to cause regular currents within the chamber and effect a more complete deposit of the flue dirt.

58 Circular stairway.—Around this down-comer will be secured a 24″ circular stairway, with plate-iron risers and wrought banisters and railing, arranged to reach the furnace top and get at the cleaning and explosion doors arranged on this pipe.

Brick-work. Hearth bottom.—The brick-work of this furnace will commence with a fire-brick hearth bottom, 45 in. thick, composed of two layers of blocks, each 18″ thick, under which will be 9 in. of 9-in. bricks, laid to thoroughly bond. The hearth bottom will rest upon the foundation and will have the aforementioned bands surrounding it, and between it and the column foundation will be a space of 15″, so that water may be caused to flow over the

hearth and bottom wall and away at the bottom of the hearth bricks. This plan avoids the danger of cutting away of the bottom by the liquid iron and its approach to the column foundation indicated. Should the iron approach the outer edge of the walls it will be observed and may be beaten back by water. The water is drawn off by a pipe at a level with the bottom of the hearth.

Hearth and bosh walls. Inwall. Backing.—The hearth walls and bosh walls will be 27″ thick and laid in alternate courses of two 13 & ½ in. bricks and three of 9-in. bricks, making a perfect bond. These bricks will be carefully moulded and laid with a minimum of well-calcined clay. The inwall will be of 22 & ½ in. in thickness and be backed with 4 & ½ of No. 2 fire-brick. Between this brickwork and the shell will be a space of 4 & ½ inches, filled with soft salmon fragments in iron run out suitable length and width and cinder through, extending 15 feet from furnace walls, will be put in place.

All the outside of the iron-work will have one good coat of mineral paint.

Hearth and bosh bricks are to be equal to the crown Scioto. Inwall equal to the No. 1 Scioto.

59 *Specification.*

Nine (9) 20 x 65 ft. fire-brick hot-blast stoves.

Stoves.—We will erect upon foundations prepared by us nine (9) Gordon-Whitewell Cowper fire-brick hot-blast stoves, each 20 feet in diameter and 65 feet high to the crown of the wrought-iron arch.

Plate iron.—The plate iron of the bottom, the top, the ring at the bottom, and the ring at the spring of the arch will be twelve pounds per square foot. All the other plating will be 9 & ½ pounds per square foot.

Riveting.—All the perpendicular seams, the cross-seams on top, and the seams joining the top and shell and the bottom and shell will be double-riveted. All other seams will be closely single-riveted and all will be caulked tightly.

Hot-blast valve.—The hot-blast valve will have a clear way of 26 inches. Its casing will be made of 10-pound plate and will be 44 inches in diameter. The seat, a bronze casting, water-cooled, will be set with a taper fit in an air-cooling ring, bored to accurately fit it. This ring will be riveted to the casing both above and below the air-cooled channel, securing an opportunity to carefully caulk the joint and to observe any leaks that establish themselves in the internally secured seat rings. The valve is hollow, water-cooled casting, operated by a hand wheel and rack and pinion. The stem plays through a ball-seated gland, which may be adjusted with the greatest nicety to procure proper seating of the valve and seat. This is sometimes required when changing a seat or valve or by expansion strain of the piping. Below the seat and valve a manhole 11″ by 20″ is riveted, on which is bolted a light door, the joints be-

ing properly machined to fit air-tight. Through this the valve and seat may be observed while they are being adjusted.

Gas-inlet valve. Butterfly valve.—To the side of the wrought casing of the hot-blast valve we will attach an elbow to which shall be bolted a gas-inlet valve with a water-cooled valve and seat, 24″ in diameter clear way. This valve will be operated by a rack and pinion, and, as great accumulations of dirt occur in this valve
60 and in the rack teeth, a slide valve is provided, to be used when the blast is on for cleaning out this dirt by the blast. Connecting this valve with the gas main there will be a pipe provided with a butterfly regulating valve, made so as to be replaced with great ease.

Chimney valve.—The chimney valve will be 46 inches in diameter clear way. The valve is hollow, and by the action of the chimney draft the air is drawn into it through the stem and circulating around the disc keeps it very cool. The seat is cooled by the air being drawn from the outside into the hollow space between its walls by the chimney draft. This seat is set in a ring riveted to a wrought shell forming the bottom of the chimney, to which is riveted the body piece of the valve chamber, and to this is bolted the cap carrying the ball-seated gland through which the stem plays. This valve is operated by a rack and pinion from the ground in front of the stove.

Chimney. Chimney bracing.—Above the valve rises the chimney, which is 45 feet high all told from the top of the stove, and is lined with fire-brick half way up to a clear way of 56 inches. The plate iron composing it is $\frac{5}{16}$ in. thick at the bottom and gradually thins to $\frac{1}{8}$ in. thick at the top, where it is stiffened with a band of iron $2 \& \frac{1}{2} \times \frac{5}{8}$. The weight of the chimney is received by five struts, composed of three T bars 5″ x 3″ and two eye beams 7″ deep. These struts act as tie-braces and their compressive action is received either by the walls of the shell or by the roof stiffened by a 7-inch eye beam bent round and riveted to it.

Cold-blast valve. Ease of operating the stoves.—Alongside of this chimney valve is the cold-blast valve, 26 inches clear way. This valve is operated by a rack and pinion and wire rope from the ground in front of the stove. There is no running around the stoves required; no possibility of mistake is offered; time is saved and any man in half hour can be used as stove-tender. All the valves are together and numbered according to the order of operating. This valve has a small slide valve on top of it, which automatically opens first, through which the stove is filled and a balance of pressure is established, after which the large or main valve will move freely and without wear.

61 Platforms.—To get about on top and reach both the chimney and cold-blast valves in a convenient manner a gallery is provided on one side formed of open cast plates secured to brackets, which are surrounded with a wrought-iron railing. This gallery is approached by a wrought-iron ladder from the ground, made of 2 inches x $\frac{7}{16}$ inch iron side and $\frac{5}{8}$-inch rounds.

Air valve. Cleaning crane. Convenience of apparatus.—The

main air valve is placed underneath the gas-inlet port and is a poppet valve 24 inches in diameter. It sets upon the door of a cleaning port, which is hinged to a frame. This whole door and valve may be at once removed to clean the bottom of the combustion chamber. The port has a clear oblong opening of 36″ x 36″. On the top of the combustion chamber there is another port of the same size, below which there is a wrought-iron gallery. From this gallery a cleaning device is operated by which in an hour's time each consecutive flue in the first down pass may be swept with steam or blast. One of the cleaning cranes is permanently fastened to each stove shell and is permanently connected with blast and steam. It is only necessary to open the swinging door and turn on the blast and steam and swing the crane in the opening, all of which one man can do. A convenient apparatus will be often used and an accumulation of dirt avoided. It is this that has been suffered to form that renders stoves so inactive, and, no matter how good a cleaner may be, if it is difficult to use its use will be neglected.

Eyesights.—Eyesights, with very neat and convenient peep-holes, are riveted at three points to observe combustion, by the appearance of which the gas and air supply is regulated.

Water pipes.—Water valves, pipes, and hose will be attached to several inlets and outlets of the water-cooled valves and seats in a very workman-like and substantial manner.

Brick-work. Combustion chamber. Down pass. Chimney pass. Independent expansion in hot & cold chimney side. No packing. Limit.—The brick-work will be lined close and tightly throughout. The combustion chamber and arch roof will be of first-class refractory fire-brick of the Scioto No. 1 or equal character. In the down pass the spaces will be 9 in. square and the walls 4 & ½ in. thick. It will be laid with a good bond throughout, tying into the combustion-chamber wall, the circle wall, and the middle or dividing wall. It will be laid with the No. 1 of the Scioto or equally good character. There will be 7 arches 9 in. thick and 15 in. deep, having a spring of 6 ft. 7 in., and these, together with the bond in the walls, support the checker-work. The last or chimney pass is composed of 11 & ¼ in. x 5 in. x 2 & ½ in. bricks laid in a thorough bond to form 4 & ½ in. x 4 & ½ openings with 2 & ½ in. walls. These will be of No. 2 Scioto or No. 1 St. Louis character and will be all carefully pressed and laid with dipped clay. The entire chimney pass will be laid without any bond with the hot side, that each system may expand and contract without racking the other. On top of the chimney arch the chimney brickwork rests, which has no fastening to metal-work in any way, but is contained in a metal casing and may play up and down the chimney. Such is the design of construction that no tendency exists for currents towards the stove shell, and the heretofore packing required between the bricks and shell, so fruitful of strains, has been entirely done away with without even a hot spot appearing on the shell.

The stoves are each complete and ready to be dried up and used. The construction commences with and includes the cold-blast valve

and ends with the hot-blast valve casing next above that valve proper.

All this work to be carefully painted with one coat of good mineral paint.

63 *Specification.*

Blowing engines for the Alabama and Tennessee Coal & Iron Co.

Blowing engines. Blast valves. Rotation of blast valves. Blowing-cylinder packing.—There will be seven (7) blowing engines, 4- stroke, blowing cylinder 84″ in diameter and steam cylinder 36″ ed diameter. The blowing cylinder will be provided with 80 4 & poppet valves for inlet of the blast and 40 4 & ½ for the outlet. All of these valves, whether inlet or outlet, will seat perpendicularly by gravity upon a circular inserted seat, provided with screw-formed ribs or arms, which will slightly rotate the disc valve at each lift. By this continued rotation the leather face will wear smooth and not cut on the ribs. When any one of these valves require- replacing the least trouble will be experienced, as each seat of each 4 & ½ inch valve can be at once removed without disturbing any of the other valves or seats. The blowing-engine pistons will be provided with brass packing rings set out with springs. These springs may be readily exchanged by removing a light sectional follower.

Steam-piston packing. Self-adjusting cross-head. Guide-bars. Steam cylinder.—The steam piston is constructed with the best spring packing, the follower being on top and the nut to fasten the piston also on top. The piston rod is in two pieces, each 5 & ½″ in diameter in the rod portion. The upper rod, that passing into the blowing cylinder, has forged upon it a boss, into which the steam rod is keyed, thus making the two rods one, yet independent of the cross-head. Through the boss in the upper rod is shrunk a pin 5′ in diameter, and on this is hung and will oscillate the steel cross head, which shall be 22″ deep, 7 thickness of the flanges, 9 ft. 3 & ½ in. distance from centre to centre of the side-rod bearings. The cross-head is guided by four guide-bars, upon which play slippers 9 x 16″, which are adjustable with screws and nuts. These slides are placed so far apart that the cross-head may be introduced between them freely. The ste-m cylinder, 36″ in diameter in clear, is of
64 the best cylinder metal and bored and faced with the greatest accuracy. Its metal walls are 1 & ⅝″ inches thick, and flanges 2 & ¼″ thick. The heads are heavily braced and the stuffer is 5″ deep and bushed with brass rings.

Valves. Valve gear.—Double-beat balance poppet valves. Steam valves, 5 & ½″ and 6″ and exhaust 6″ and 6 & ½″, and will be operated by an adjustable eccentric cut-off gear, capable of a regulation from one-quarter to three-quarter-, followed instantaneously while the engine is in motion and always maintaining exact lead and cut-off. This gear has no traps or let-go catches or springs. It is quite as reliable as a common eccentric.

Main shaft. Fly-wheels.—The shaft, 12 — in diameter, is of

hammered wrought iron, revolving in babbitted bearings fitted into the main bed plate; the bearings are 12″ in diameter and 24″ in length on each side. On this shaft is shrunk and keyed two built fly-wheels 15 & ½ feet in diameter and 10 tons each in weight. The centres of these are faced and bored and keyed on the shaft, after which the wrist-pin holes are bored out and pins shrunk in, ensuring an accuracy that cannot be obtained where the keying is done after the wheels are bored for the wrist-pins.

Wrist-pins. Accuracy of boring. Speed.—These wrist-pins are 6 & ½ in. in diameter and 6 & ½ in. in length of bearings. The whole engine put up in the most careful mechanical manner of approved designs for economy of steam (will be guaranteed to run well at a speed of 45 revolutions under constant regular work and to a blast pressure of 10 pounds per square inch. It may, however, be tested at a speed of 60 revolutions, at which speed we guarantee its perfect action). Around all of these engines at a suitable height for ready attention to the blowing-cylinder valves will be placed a lattice gallery, supported by iron brackets and iron girders.

65 *Specifications.*

(3) Three casting-houses, accompanying proposition to Alabama & Tennessee C. & I. Co.

Roof.—The casting-houses will be brick buildings, covered with an iron roof 50′ span and 150′ long and 25′ high to eaves. There will be 12 trusses in each roof, the main members of which will be made of 3 & ½ x 3 & ½; the bars braced with double struts and tie-bars; 2 x 3 angle purlins will be disposed at 36″ intervals upon these rafters, and to these purlins No. 20 corrugated sheet-iron roofing will be attached.

Ventilators.—The ventilators will be 72″ wide and 48″ high, extending over all the trusses except one. It will be strongly braced and covered with No. 20 corrugated iron.

The brick walls will be 13″ thick and under each rafter they will be thickened by 18″ pilasters. There will be 12 doorways on each building and three upon each of the lower gable ends. The lower corners of these doors will be protected with cast-iron jam plates built into the walls. The walls will be 24″ high from top of hearth level.

Overhead tracks over each pig-bed, with cradle to carry 1 & ½ tons of pig metal, will be erected in place in a most substantial manner. The trolly is to be provided with friction, less journal bearings to avoid the use of oil.

Boilers.—12 Babcock and Wilcox boilers, set in six batteries; total heating surface, 21,480 square feet.

Sections.—There are to be 12 boilers, arranged and set in 6 batteries, each boiler to be composed of 10 sections or slabs, each section to be composed of eight best lap-welded wrought-iron tubes 4″ diameter and 18 feet long, connected at the ends by continuous staggered headers or "uptakes" and "downtakes;" the tubes to be

fastened therein by being expanded into taper holes; each "header" to be provided with manholes, placed opposite the end of each tube, of sufficient size to permit the cleaning, removal, and renewal of a tube through the same; each *hand*hole provided with a cap fastened with wrought-iron bolts and clamps and top nut, all joints being made tight without packing of any kind; the several
66 sections to be connected at each end to a steam and mud drum, and at one end with a mud drum by means of lap-welded wrought-iron tubes 4″ diameter and of suitable length, expanded into bored holes.

The four steam drums to each battery are to be 30″ diameter and 18 ft. 7 in. long, made of flange iron $\frac{5}{16}$ in. thick, the longitudin*ous* seams double-rivetted, each to have a manhole in front ends, two nozzles, one for safety valve and one for taking off steam, 4″ diameter, the main steam outlet being 6″ in clear. Each battery will be supported by wrought beams set on iron columns, with cast base*d* plates properly secured, so that the boilers shall be sustained entirely independent of the brick-work and free to expand or contract without affecting the same and so that the brick-work may be removed and renewed if required without disturbing the boilers and connections.

Fittings.—Each boiler to be provided with two Consolidated Co.'s nickel-seated safety valves 3 & $\frac{1}{2}$″ diameter, set to blow off at 90 pounds pressure.

One steam g*uag*e dial 10 in. in diameter.

One stand-pipe with large-sized glass water g*uag*e, fitted with independent cleaning pipes and valves, and three patent g*uag*e cocks with lifting handles.

One check-valve.

One stop-valve.

One blow-off valve.

One stop-valve $\frac{3}{4}$ in. diameter for cleaning pipe connections.

The necessary pipes and fittings for fixing all of the above boilers.

The front to be our "Special" pattern, containing two fire-doors with registers, 2 double ash-pit doors, and large doors for access to the ends of the tubes, all the parts to be ample in strength, joints fitted and to be fitted with one of our large gas burners.

The fixtures for each battery of boilers to consist of a full set of grate bars with bearers, dead plate and girders, flame bridge plates with bolts, and special fire-bricks for lining the flame bridges, bridge wall girders and bars, bender & bolts, 6 ash and ten cleaning doors for access to the exterior of the tubes and the flues for cleaning, one damper with frame and the requisite lintels for openings in
67 walls, smoke-chamber tees, and anchor bolts for fronts.

Tools.—A steel wrench fitting the manhole nuts, a pair of tube-scrapers with handles, a set of fire tools, consisting of pokers, slice-bar, and hoe, and hose and pipe for blowing dust from exterior of tubes.

Testing.—The sections and mud drums to be tested and made tight under a hydraulic pressure of three hundred lbs. per square

inch and the steam and water drums to be tested and made tight under a hydraulic pressure of 150 lbs. per square inch.

All the material and workmanship to be first class in every particular.

Stock-house.—The stock-house will be constructed of wood, seventy (70) feet span from centre to centre of posts and (400) four hundred feet long from end to end. It will be divided into forty (40) panels ten (10) feet each. The posts will be 10″ x 10″ yellow-pine timbers and (30) thirty feet high, strongly framed.

The main members of the rafters will be 7″ x 8″, strongly trussed and bound together with iron bolts; four (4) inch wooden purlines, placed 32″ apart, will be fastened to those rafters and upon these will be securely nailed a No. 24 corrugated iron roofing on this entire structure and over a six-foot extension on each side of it, thus making the covered surface 82 feet wide and 400 feet long. A two-inch flooring spiked to 5″ x 5″ stringers will cover the entire space within the posts. This building is to be a thoroughly strong structure. It is not to be painted, neither have we the tresseling to put in for the railroad tracks. At three points suitably located for the hoist-towers we will place a six-beam Fairbanks charging scale of the most approved pattern.

The hoist and scale pits are to be thoroughly drained and an eave trough with spouting of ample and satisfactory dimensions securely placed along the roof edge next the furnaces draining into the stock-house drains.

Charging barrows.—The barrows, 36 in all, half for fuel and half for ore and limestone, are to be made with steel-plate bodies $\frac{3}{16}$″ thick at the bottoms and $\frac{1}{8}$″ thick at the sides and corners, formed on 1 & $\frac{1}{2}$ x 1$\frac{1}{2}$ angle iron all around the edge. The wheels are fast on the axle, each wheel having an independent axle and rolling either way independent of the other axle. The wheels are all of wrought iron except the hubs.

68

Engine-house.

Walls.—The engine-house will be 120 feet by 34 feet over all and 30 high from the ground line to the eaves of the building. The walls will be of brick 13 & $\frac{1}{2}$ in. thick with 4 & $\frac{1}{2}$ pilasters. There will be built in the sides of these walls two large doors, windows, air ports, and small doors.

Floor.—The floor will be made of 2″ yellow pine spiked to 14″ x 3″ joists placed 14 centres and properly bridged. At suitable locations two vise benches and vises will be placed.

Roof.—The roof will be a frame structure of such strength that the heaviest piece of the engine may be hoisted upon it. The roof will be covered with No. 28 crimped iron, painted, laid on close-fitting sheeting. A neat cornice will be placed upon the eaves of the building and proper water spouts erected to avoid dripping about the building.

Feed-pumps.—To feed the boilers three duplex plunger pumps will be provided, set in the engine-room. These pumps have 12″ steam cylinders, 7″ water plunger, and 10″ stroke.

Heaters.—Within this building will be placed 7 water-tube heaters 24″ in diameter x 10″ high. They will contain 30 tubes of 2″ diameter of corrugated copper. These heaters will — constructed with removable bottom and top, and so arranged that the tubes through which the water flows can be scraped out without delay and while the blowing engine is going. There is a safety valve attached on top to avoid undue strain should the boiler tender close the stop-valves too closely for the feed-pump speed. The water from the feed-pump passes in at the bottom and out at the top, at each of which points proper stop-valves are provided. To each heater the exhaust-steam pipe of the main engine will be attached, and from it the exhaust-steam pipe will pass up above the roof of the house. If it is desired to feed the boilers while the main engine is stopped a live-steam pipe provided may be used to heat the water.

69 River pumps, dry well, water tanks, and piping.

On the river bank will be constructed a wrought-iron tank 14′ diameter of top, 17′ diameter of bottom, and 26′ high, made of plate iron $\frac{1}{4}$″, $\frac{5}{16}$″ to $\frac{3}{16}$″ thick, riveted and caulked water-tight and stiffened with angle and tie bars. It will be placed on foundations sufficiently low that the pumps within may at the lowest stage of the river draw the water, and the sides of the tank will be sufficiently high as not to be submerged by the highest known water. On the bottom of this dry well will be riveted four I beams, on which will be bolted two duplex steam pumps, steam cylinders 18″ in diam., water piston 12″ diameter and stroke 10″. These pumps have 8″ suction and discharge 10″ in diameter, and in each of these connections the stop-valves will be placed that either pump may be thrown off at pleasure. The suction will pass water-tight through the dry well or tank out in the river channel and the 10″ discharge pipe will discharge its water into the reservoir. We are to dig out and wall up in cement on the ground near the furnaces. From this reservoir will be drawn the water by three duplex pumps same size as above through a 12″ suction and discharge it through a 12″ discharge pipe into the water tanks or independent pipes of equal capacity.

The two water tanks will be 20 feet diameter and 15 feet high, composed of plate iron 14 lbs. per square foot at the bottom and thinning to seven lbs. on the top. These tanks will be supported on 8 columns of cast iron stoutly trussed and set in foundation plates. To each and from each will lead 8″ water pipes, and they will be provided with overflow and washout piping. These tanks will be sway bottom and the washout will be placed in the lower point. In this way all the settling may be removed by flushing them.

Three (3) hoist-towers.

Hoist-tower, columns, struts, guides, roof.—The hoist-tower will be 93 ft. high from the floor of the stock-house to the upper end of

the columns. There will be six columns, composed of two
70 channel irons of 7″ width, 42 pounds per yard, latticed to each other, placed 8′ 6″ from centre to centre. The joints will be butt-strapped. The struts, all around and between the center columns, will be 5″ eye beams and tie-rods 1″ diameter, with turn-buckles and adjusting screws, will cross at each lattice, except that used to put the buggies on the cages and to take them off. The guides will be made of wood upon which the safety grips bond. These are secured to 7″ channel irons running all the way up and down each side of each cage space. This structure is provided with a 12″ eye beam crossing and secured to three columns. This beam supports the ends of the bridge beams from the furnace. On top of this structure four yellow-pine beams will sustain the four sheaves on which the hoisting rope plays. A wrought framing will carry a No. 20 corrugated iron roof, and the sides down to the level of the platform will have No. 22 corrugated irons sheeting secured to proper purlins. A house 10′ 3″ x 13′ 3″ constructed of brick will be built in contact with this tower to contain the hoisting engine. It will be well and strongly made, with proper doors and windows, neatly floored and roofed. All the iron-work to be painted with one coat of good mineral paint.

Hoist-engine.—The hoist-engine will be of the automatic type, double cylinders, 12″ stroke, 10″ diameter, with brakes and automatic stop, steel ropes from drum. Hand line by which the engine will be handled by the top filler is conveyed over guide-sheaves. This engine operates two cages, balancing each other, 7′ x 7′ in size, upon which the unbalanced load of 2,500 pounds can be hoisted with proper speed. The cages are furnished with safety pawls. This engine will be equal in all respects to the best made.

Three (3) hot-blast mains.

Hot-blast main, drop-valve.—The hot-blast main will consist of a wrought, riveted, and caulked piping 44″ in diameter, made of $\frac{3}{16}$″ plate iron. It will be connected by easy circular elbows and mitred branches to the hot-blast valve casings. This will be lined with fire-brick to a clear diameter of 26″. It will be swung from each hot-blast casing with a 1 & $\frac{1}{2}$″ hanger rod,
71 with adjustable stirrups, and to each hot-blast casing by riveting on two 4 x 6″ angle iron 4 feet long, and through these and through a forging eye on the rod a pin 1 & $\frac{1}{2}$ inch diam. will pass. On each hot main we will rivet a 10″ automatic drop-valve to permit the escape of gas when blast is off the furnace, all painted outside with one coat of mineral paint.

Cold-blast mains.

The blowing engines will be connected to the cold-blast mains by *by* branches in which there will be 12 cut-off valves 24 in. diameter in the clear. The cold main will be 30″ in diameter, made of $\frac{1}{8}$″ plate iron. It will be connected with the cold-blast valves of the fire-brick stoves with flanges and be carried by proper gussets and

supports to prevent swaying or motion, this to be carefully painted on the outside with good mineral paint. Each of the 7 blowing engines will be connected to the cold-blast main pipes so that either of 4 engines may be used on one furnace by the aid of the 24″ cut-off valve above.

## Sewers.

A circular sewer, 30″ in diameter in the clear, made of well-burned bricks on edge to center, will extend from the remote furnace to the engine-house and to the boilers and thence to the reservoir. All the waste water from the furnaces, stoves, heaters, and boilers will be emptied into the sewer and through it be conveyed to the reservoir, at each furnace, at the engine-hosse, and at the boiler necks will be built to the sewer into which the waste water will empty. The relative altitude of this sewer and the reservoir will provide a suitable fall to the sewer and then empty into the upper portion of the reservoir. The furnace flues carrying the gases from them to the boilers and stoves will be constructed of 9″ fire-brick walls and arch and 4 & ½ inch bottom. It will be made in a horseshoe shape and the bricks laid carefully in clay where it passes through good, solid earth. After the flues are built good,
72 dry earth will *will* be carefully rammed in all around and up to the top of arch; but where the earth is wet or unsuitable for the flue, retaining walls of stone laid in cement will be put in. At intervals of 18 feet a cleaning explosion door will be built into the arch two feet wide and 4 feet long. Spars from the flue will convey the gas to the stoves & boilers. This flue will commence with an area of 30 square feet till reaching near the second downcomer, then enlarge to an area of 40 square feet and diminish gradually as the gas is taken away for the stoves and the boilers, but at the very end will be not less than a clear area of 17 square ft.

## Reservoirs.

A reservoir will be excavated at a suitable location near the engine-house, having an area after being lined of 6,000 sq. ft. This will be walled with 9 inches of good red brick laid in cement and slightly inclined outerward; a depth of 6 ft. outside of this wall the earth will be rammed in hard. The bottom will be formed of bricks laid in cement upon a thoroughly hard-rammed bed of clay. The whole is to be made water-tight and serviceable, and should the location develop imperfect bottom for such a floor the same is to be made suitable with cement or otherwise. The water from the river pumps will empty into this and from it the water is to be drawn to supply the tanks; an overflow will be provided to carry the excess of water to the river.

Foundations.—The foundations will be built on suitably prepared earth or stone natural bed, or when such is not found at the desired line the bed will be made secure by such engineering expedients as will be most suitable to the situation. They will consist for the outer edge of stock-house of stone piers well set, 2 feet square on top and varying in width of base to the height. On the river

edge there will be a continuous rubble wall of ample strength, its thickness being made to suit the height found desirable. The furnace foundations will be laid in sandstone, total depth from hearth down being not less than 12 ft. The top will consist of No. 2 firebrick, forming the wall in which is built the hearth bottom. The sandstone will be lain in careful bridge bond and well grouted. The stone foundations will be stone masonry well bonded and with liberal use of mortar. They will be solid throughout and
73 capped with 12 inches of good hard red brick.

The engine-house foundations will be laid, say, 10 ft. deep, or up to the level of the furnace surroundings, and to be 2 ft. wide at top and 3 ft. at the bottom. The engine foundations will be hard red-burned brick laid solid and compact in cement. The casting-house and boiler walls, retaining walls for cinder pits, tank and pump foundation are all to be a thoroughly good rubble-work, laid in mortar, of reasonable sized stones. All the foundations are to be fully competent for the duty required; to be made of suitable material and first-class workmanship.

Miscellaneous.

We also propose to furnish a water bosh for the tools of each furnace piping and hose for pig-bed purposes, three pyrometers, three mercurial blast *guages* in the engine-house and one at each furnace, and special wrenches for the engines, oilers for the engine cylinders and bearings, the engines and pumps to be properly packed and ready for use. We do not, however, include the felting or covering thought to be desirable to steam and water piping and vessels, nor the small and moveable tools (other than enumerated), such as sledges, stopping hooks, bars, cutters, files, lamps, oil cans, and oil vessels; neither is the sand in pig-bed included, nor cinder nor iron cars or buggies or trucks of any kind, or railroad scales.

Around the furnace, stoves, engine-house, and boilers the ground will be carefully leveled off, giving it a suitable pitch for surface drainage, and the clay floor well rammed.

___ ___.
___ ___.

We accept above specifications in full as written.

ALABAMA AND TENNESSEE
COAL & IRON CO.,
By *By* EDWARD DOUD, *Supt.*

74 (D.)

*Evidence & Exhibits of Jas. C. Gray. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

75 In the Circuit Court of the United States for the Northern District & Northern Division of Alabama, at Huntsville.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY COMPANY and Another.

Evidence submitted in the petition and intervention of Gordon, Strobel & Laureau, Limited, before the Hon. D. D. Shelby, master in chancery, at his office, in Huntsville, Ala., Wednesday, September 11th, 1889, all parties at interest being represented by counsel.

Intervenors offer in evidence, first, the original contract set out as Exhibit A B to the petition, it being agreed that the copy attached to the petition may be used in lieu of the original.

JAS. C. GRAY sworn for the intervenors.

Direct examination by Mr. GUNTER:

Q. Are you at present a member of the firm of Gordon, Strobel and Laureau?
A. No, sir.
Q. What connection did you have with them?
A. I was their general Southern agent.
Q. When this original contract was entered into?
A. No, sir; about a month subsequent.
Q. Gordon, Strobel & Laureau went on and constructed the works proposed in this contract?
A. Yes, sir.
Q. State what you know about the work being accepted by said company.
A. (Exhibits letter of acceptance.)
Q. Who was president of the party for whom the furnaces were erected at that time?
A. Mr. E. W. Cole, of Nashville.
Q. Did you give them any notice in reference to the acceptance of the work?
A. Yes, sir; we did. (Reads copy of telegram sent E. W. Cole.)

76 Counsel for defendants object to the reading of any telegram purporting to be a copy of one sent E. W. Cole.

By Judge BRICKELL:

Q. Are those the words of a telegram sent Col. Cole?
A. They are.

By Mr. WHITE:

Q. Was the telegram furnished the telegraph office in writing, do you know?
A. I do not know.
Q. Did you send the telegram?
A. No, sir.
Q. You have no practical knowledge of what occurred?
A. It was submitted to me.
Q. At what time?
A. Subsequent to the sending; probably two weeks.

By Mr. GUNTER:

Q. Do you know whether or not any telegram was received from Mr. Cole?
A. I have it here.
Q. Do you know it was received?
A. It was handed to me either by Mr. Hammond or Mr. Gordon, who were at Sheffield.
Q. Did you receive an acceptance from same person?
A. This letter was received by our Philadelphia office.
Q. Did you make application to Mr. Doud to have it accepted?
A. Mr. Gordon did; I was not present.
Q. Did your Philadelphia office receive this letter?
A. Yes, sir.

Intervenors here introduce a letter, marked Exhibit No. 1 to the depositions of Mr. Gray.

Q. Do you know Mr. Doud?
A. Yes, sir.
Q. What position did he then hold with respect to that company?
A. He was superintendent of the furnace department.
Q. How long had he been so up to that time?
A. From either January or February, 1887.
Q. How long did he continue so afterwards?
A. Until some time in the latter part of 1888.

By Judge TOMPKINS:

Q. What is the date of that letter?
A. August 18, 1888.

77 By Mr. GUNTER:

Q. State what amounts of payments had been made on the contract up to the filing of that lien and what balance was due.
A. $514,500 was paid up to the date of filing the lien.
Q. No payments since August 18th, 1888?
A. No, sir.
Q. There was how much paid?
A. $514,500.
Q. Any payments made since the acceptance?
A. The last was about August 15th, 1888.

Q. What was the amount of the contract?
A. $564,000.
Q. Was there anything extra?
A. Yes, sir; freight excess, $9,618.16, and $1,194.50 for material furnished them after blowing in the first furnace.
Q. The total was how much?
A. $574,812.66.
Q. How much had been paid on that?
A. $514,500.
Q. Leaving a balance of how much?
A. $60,312.66.
Q. What position did you hold with respect to these intervenors while this work was going on?
A. I was Southern agent, attended to collecting, etc., with my office at Nashville.
Q. Did you render bills to defendant- as regards freights?
A. Yes, sir; I did.
Q. They made payments on them?
A. Yes, sir; they did.
Q. Did they make any objection to the excess of freights?
A. Yes, sir; from time to time, as objections were made to them by the railroad company.
Q. Did they make any objection to the excess of freights as being a part of the charge under the contract?
A. No, sir; and payments were made on this as a part of the regular work.
Q. Have you any letters or accounts rendered showing excess freights and payments on them?
A. Yes, sir.

(Intervenors introduce letter from secretary of the Sheffield & Birmingham Coal, Iron & R'y Co. and one paper attached thereto in explanation thereof, marked Exhibit No. 2.

Also letter from same party, with four papers attached, re-
78 lating to excess freights, marked Exhibit No. 3.

Also letter, with one paper attached, marked Exhibit No. 4.

Also letter on same subject, with two papers attached, marked Exhibit No. 5.

Also letter, with three papers attached, marked Exhibit No. 6.

Also a letter marked Exhibit No. 7.

Also a letter, with one paper attached, marked Exhibit No. 8.)

Q. The whole amount of your excess freight was $9,618.16?
A. Yes, sir.
Q. That entered into the general account?
A. Yes, sir.
Q. The original contract price was $564,000, on a basis of freight at 13½c. per hundred pounds. You had to pay in excess $9,618.16?
A. Yes, sir.
Q. So that increased the price that amount?

A. Yes, sir.

Q. The price was increased by materials furnished, which they ordered from you after the acceptance, to the amount of $1,194.50?

A. Yes, sir.

Q. You rendered the bill?

A. No, sir; it was rendered directly from our Philadelphia office and did not come through me.

Q. You rendered statements?

A. Our firm did.

Q. Was there any objections made?

A. I cannot say.

Q. The total, then, was $574,812.66, and on that payments have been made of $514,500?

A. Yes, sir.

Q. What payments were made up to August 8th, 1888?

A. The last payment was $5,000, and was made August 15th.

Q. That would be $509,500 up to the 8th August?

A. Yes, sir.

Q. The balance due them is $60,312.66?

A. Yes, sir.

Intervenor- then introduced the mechanical lien filed, marked Exhibit No. 8.

Cross-examination by Mr. WHITE:

Q. Are you testifying in these matters on your own knowledge or from information given you?

A. From my own knowledge.

Q. These payments you testify to were made through you?

A. Yes, sir.

79 Q. The payment on the 8th was made through you?

A. Yes, sir.

Q. Did you pay these excess freights or did you get your information from books concerning them?

A. From the bills themselves.

Q. What bills?

A. Issued to us as receipts by the railroad companies at Sheffield.

Q. These bills were issued by the carriers at your foundry?

A. No, sir; by the railroad agent at Sheffield.

Q. When freights came to Sheffield the rates were more than 13½c.?

A. Yes, sir.

Q. These letters are in reply to bills rendered by you upon information from Sheffield?

A. Yes, sir.

Q. Have you got these bills?

A. No, sir.

Q. Where are they?

A. I expect they are in the hands of the general freight agent at Louisville.

Q. General freight agent of what?

A. Of the Louisville & Nashville railroad.

Q. How did they get in his hands?

A. This company arranged with the Louisville & Nashville railroad to carry their freight at certain rates.

Q. Do you know that these bills are back there?

A. I know it from information of Mr. Jones.

Q. You do not know it of your own knowledge at all?

A. No, sir.

Q. What did you do with the bills?

A. Presented them to Mr. Jones.

Q. You have never seen them in this State since that time?

A. No, sir, as the office was in Nashville?

Q. Then that $9,000 excess has been paid?

A. No, sir; there is a balance due of about $2,500.

Q. As you rendered bills for excess freights you were paid on them to the extent of those letters?

A. We were paid about $7,000.

Q. That account was kept separate from the construction account?

80 A. It was at one time, but was separated at Mr. Jones's request.

Q. Then it was kept separate and you were given credits, according to these letters, against a certain fund that had been established for this freight?

A. No, sir; it was considered a part of the contract.

Q. Were there not two separate accounts kept, one a construction account and one an excess-freight account?

A. No, sir.

Q. Where did he place these credits?

A. In our estimated accounts.

Q. You have kept them separate?

A. I kept the bills that I rendered separate from the estimate for the reason that the estimate account was kept in Philadelphia and the freight account in my office in Nashville.

Q. You made a memorandum of all these freight accounts so as to keep them separate, didn't you?

A. Yes, sir. I can tell all bills that I rendered them from the account; the freight matters all went through me. For a few months they came from the Philadelphia office, but after that I had charge of them. They (that is, the bills for a few months) were sent by me to the Philadelphia office and then returned.

Q. How did you know Mr. Doud was superintendent of that company? Ever see any order appointing him?

A. No, sir; but simply from seeing him exercising the powers of superintendent.

Redirect by Mr. GUNTER:

Q. When the freights came to Sheffield bills were rendered to your company, were they not, and you paid them?

A. Yes, sir.

Q. Then you took the bills and rendered accounts of excess freights to whom?

A. To the Alabama & Tennessee Coal & Iron Co. at Nashville, and these letters were in reply to those communications; there were a few returned to me, but not of any account.

Recross by Mr. WHITE:

Q. What do you mean by not of any account?

A. A few in which errors had been made and which came
81 over a different road. They were returned for correction.

JAMES C. GRAY.

82 Alabama & Tennessee Coal & Iron Co., producers of pig-iron, coke, & coal.

NASHVILLE, TENN., *October* 21*st*, 1887.

Sheffield & Birmingham Coal, Iron & Railway Co.

Messrs. Gordon, Strobel & Laureau, Nashville, Tenn.

GENTS: I have this day placed to the credit of your excess-freight account $545.84, being the amount of your claim of Sept. 24th ..... $682 57
Less deduction of J. M. Culp, G. F. A., as explained in this letter attah ..... 136 73

$545 84

Yours truly, WM. S. JONES, *Secretary.*

(Copy.)

83 Louisville & Nashville Railroad Co., office of gen. freight agent. John M. Culp., gen. fr't agent; Andrew Broaddus, ass't gen. fr't agent.

In your reply refer to claim No. B 10604.

LOUISVILLE, KY., 10, 10, 1887.

Alabama & Tenn. Coal & Iron Co., Nashville, Tenn.

DEAR SIRS: Your claim for $682.57 has to-day been vouchered for $545.84. The difference between am't as claimed & am't of voucher is on acc't of charges paid at Cincinnati, $133.01, and at Lexington, $4.76.

Yours truly, J. M. CULP, *G. F. A.*

(Copy.)

Sheffield & Birmingham Coal, Iron & Railway Co.

NASHVILLE, TENN., *Oct.* 13, '87.

Mess. Gordon, Strobel & Laureau, Nashville, Tenn.

GENTS: I have to-day placed to your credit on account of excess freights the sum of $264 02, being the amount of your claim of Sept. 19, '87 ..... $282 25

Less amount deducted by J. M. Culp, G. F. A., L. & N. R. R., as explained in his letter attached ..... 18 23

$264 02

Yours truly, WM. S. JONES, *Sec'ty.*

For attention on my return, awaiting reply of J. G. B. in regard to transfer at Cinti. Subject, as 15.00 of above deductions are from that cause. See attached note.

J. C. G.

10. 4. '87.

84 Louisville & Nashville Railroad Co., office of gen'l freight. John M. Culp, gen. fr't agent; Andrew Broaddus, ass't gen. fr't agent.

In your reply refer to claim No. B9129.

LOUISVILLE, KY., 10, 6, 1887.

Alabama & Tenn. Coal & Iron Co., Nashville, Tenn.

DEAR SIRS: Your claim for $266.08 has to-day been vouchered for $247 85. On 3 cars via Cincinnati there was $5.00 per car charges for transfer from B. & O. depot. On the balance of shipments there was $3.54 charges via Lexington.

Yours truly, J. M. CULP, *G. F. A.*

ALABAMA & TENNESSEE COAL & IRON CO.,
NASHVILLE, TENN., *Nov.* 9, '87.

J. C. GRAY, Esq., sup't, Nashville, Tenn.

DEAR SIR: This settles all claims you have filed to this time. Will you please bring down your book and we will compare the figures before filing other claims, and oblige,

Yours truly, WM. S. JONES, *Sec'ty.*

(Copy.)

85 ALABAMA & TENNESSEE COAL & IRON CO.,
NASHVILLE, TENN., *Oct.* 24, '87.

Mess. Gordon, Strobel & Laureau, Nashville, Tenn.

DEAR SIRS: We this day credit your excess-fr't acc't $1,299 64, being the amount of your claim of July 6, '87 ..... $1,375 56

Less deduction made by J. M. Culp, G. F. A., and explained in his letter attached ..... 75 92

$1,299 64

Yours truly, WM. S. JONES, *Sec'ty.*

(Copy.)

Louisville & Nashville Railroad Co., office of gen. freight agent. John M. Culp, gen. fr't agent; Andrew Broaddus, ass't gen. fr't agent.

In your reply refer to claim No. B3324.

Alabama & Tennessee Coal & Iron Co., Nashville, Tenn

DEAR SIRS: I attach herewith pencil mem. showing amount of overcharge due you in above claim. I have issued voucher in your favor for this amount, viz., $1,118.91.

The paid freight bill attached was included in your claim 98295, and the overcharge refunded in that claim.

Yours truly, J. M. CULP, *G. F. A.*

85*a*

| Machinery bills. | Charges. | | L. & M. | | M. & C. | Total. |
|---|---|---|---|---|---|---|
| 335,381 | 3 11 | | 745 85 | | 416 55 | 1,165 51 |
| Sh'd be. | | | | | | |
| 335,381 | 3 11 | 9½c. | 318 61 | 8c. | 268 30 | 590 02 |
| | | | 427 24 | | 148 25 | 575 49 |
| Brick. | | | | | | |
| 700,900 | 439 95 | | 995 17 | | 494 49 | 1,929 58 |
| Sh'd be. | | | | | | |
| 700,900 | 439 95 | 9½c. | 665 85 | 4c. | 280 36 | 1,386 16 |
| | | | 329 32 | | 214 10 | 543 42 |

Claim B 3324, 10, 4, '87.

86 ALABAMA & TENNESSEE COAL & IRON CO.,
NASHVILLE, TENN., *Nov. 9th*, 1887.

Sheffield & Birmingham Coal, Iron & Railway Co.

Messrs. Gordon, Strobel, & Laureau, Nashville, Tenn.

GENTS: I have this day placed to the credit of your excess freight account $23.92, being the amount of your bill of October 6th last as rendered.

Yours truly, WM. S. JONES, *Sec't'y.*

(Copy.)

ALABAMA & TENNESSEE COAL & IRON CO.,
NASHVILLE, TENN., *Nov. 9th*, 1887.

Sheffield & Birmingham Coal, Iron & Railway Co.

Messrs. Gordon, Strobel, & Laureau, Nashville, Tenn.

GENTS: I have this day placed to the credit of your excess-freight account $466.21, being the amount of your bill of September 9th, last day ---------- $570 63
Less deductions made by J. M. Culp, G. F. A., as explained in his letter attached ---------- 104 42

Net ---------- $466 21

Yours truly, WM. S. JONES, *Secretary.*

**(Copy.)**

87 LOUISVILLE, KY., 10, 24, '87.

Louisville & Nashville Railroad Co., office of gen. freight agent. John M. Culp, gen. fr't agent; Andrew Broaddus, ass't gen. fr't agent.

In your reply refer to claim No. B. 9071.

Wm. S. Jones, Esq., sec't'y, Nashville, Tenn.

DEAR SIR: Your claim for $549.52 has to-day been vouchered for $445.10. Charges on brick via Lexington, $4.16; brick via Cin-nati, $77.34, and on machinery, $11.00.

Yours truly, J. M. CULP, *G. F. A.*

549 52
445 10

104 42 deduct.

ALABAMA & TENNESSEE COAL & IRON CO.,
NASHVILLE, TENN., *Nov. 9th*, '87.

Sheffield & Birmingham Coal, Iron & Railway Co.

Messrs. Gordon, Strobel & Laureau, Nashville, Tenn.

GENTS: I have this day placed to the credit of your excess-freight account $236.85, being the amount of your several claims.

| | | |
|---|---|---|
| July 23rd, '87 | $196 71 | |
| August 1st, " | 74 67 | |
| August 12th, " | 19 56 | |
| | | $290 94 |
| Less deductions made by J. M. Culp, G. F. A., as explained in his letter attached | | 54 09 |
| Net | | $236 85 |

Yours truly, WM. S. JONES, *Secretary.*

(Copy.)

88 Louisville & Nashville Railroad Co., office of general freight agent. John M. Culp, gen. fr't agent; Andrew Broaddus, ass't gen. fr't agent.

In your reply refer to claim No. B 5910.

LOUISVILLE, KY., 10, 24, 1887.

Wm. S. Jones, Esq., sec't'y A. & T. C. & I. Co., Nashville, Tenn.

DEAR SIR: Your claim for $224.32 has to-day been vouchered for $174.38. The charges up to Cincinnati and Lexington are on brick $25.00 and on machinery $29.09.

Yours truly, J. M. CULP, *G. F. A.*

89 ALABAMA & TENNESSEE COAL & IRON CO.,
NASHVILLE, TENN., *October* 19, 1887.

Sheffield & Birmingham Coal, Iron & Railway Co.

Messrs. Gordon, Strobel & Laureau, Nashville, Tenn.

DEAR SIRS: I have this day placed to your credit $450.55, being the amount of your claim of Octo. 5th---- $519 56
Less deductions explained in letter of J. M. Culp, att'ch'd- 69 01

$450 55

Yours truly, WM. S. JONES, *Secretary.*

(Copy.)

Louisville & Nashville Railroad Co., office of gen. freight agent. J. M. Culp, gen. fr't agent; Andrew Broaddus, ass't gen. fr't agent.

In your reply refer to claim No. B 10587.

LOUISVILLE, KY., 10, 11, '87.

Alabama & Tennessee Coal & Iron Co., Nashville, Tenn.

DEAR SIRS: Your claim for $519.54 has to-day been vouchered for $450.55. The difference is am't of charges paid for transfer at Cincinnati, $64.78, and at Lexington $3.48.

Yours truly, J. M. CULP, *G. F. A.*

90 (Rate Indianapolis to Cin., 17c.)

Way-bill No. 803. Car No. 962, from Dec't'r.

3–19.

Gordon, S. & L. to Memphis & Charleston Railroad, Dr., East Tennessee, Virginia & Georgia Railroad Co., lessee.

| Consignor. | Articles. | | Marks. | Weight. | Amount. |
|---|---|---|---|---|---|
| Cin. | 1 Eng. boiler, 1 stock, 1 box, 1 b'r'l g. rods, 1 bame. wheel. | | | | |
| S. L. & C. | M. & C. | 21 75 | | | |
| | Chrg. | 42 50 | | | |
| | | 69 25 | | 7,500 | 69 25 |
| | P'd r'ds. S. & B. | | | | 4 |
| | | | | | 73 25 |

(Copy.)

91 JAMES C. GRAY re-examined for Gordon, Stroebel & Laureau.

Direct examination by Mr. GUNTER:

Q. In the bill that you rendered to the defendant for freight, amounting to about $9,600, what amount of that sum did you pay out for the transfer of freight in Cincinnati?

A. About $2,500.

Q. Then, Mr. Jones, in stating that it was not more than two or three hundred dollars, was mistaken?

A. Yes; mistaken or misinformed.

Q. In the bill rendered for excess freight were there any items for freight beyond Cincinnati?

A. No.

Q. Had they been taken out of the bills rendered?

A. That is the total of bills that I presented for excess, including the transfer in Cincinnati.

Cross-examination by Mr. WHITE:

Q. The transfers that you allude to were the charges for the freight being brought from other depots in Cincinnati to the Louisville & Nashville?

A. Yes.

Q. There is no difference between your statement and Mr. Jones', with the exception of what these charges arose from?

A. There is no difference; approximately no difference.

Re-examination by Judge BRICKELL:

Q. This balance due you here—the whole amount over was $9,618.16—how much has been paid?

A. Seven thousand and thirty-three dollars, according to my statement.

Q. The balance that you claim now is the difference between those amounts?

A. Yes.

Q. What makes up that balance?

A. The transfer charges from other depots in Cincinnati to the Louisville and Nashville depot.

Q. These are the charges you paid the transfer companies
92 for transferring?

A. Yes; we prepaid all our freight to Cincinnati from Philadelphia and other places.

Q. No part of the $2,000 which you now claim is for any freight to Cincinnati?

A. No.

93 F. W. GORDON sworn for intervenors.

Direct examination by Mr. GUNTER:

Q. You are a member of the firm of Gordon, Stroebel & Laureau, Limited?

A. Yes, sir.

Q. Mr. Gordon, after the work was completed and the plant finished, did you receive any telegram from the president of the Sheffield & Birmingham Coal, Iron & R'y Co.?

A. I did, sir.

Q. Where is the telegram?

A. Here it is. (Reads it.)

Q. Did you receive any letter confirming that telegram?

A. Yes, sir. (Reads it.)

This telegram and so much of the letter as is marked are offered and attached to Exhibit No. 1 and marked A B.

Q. When you received that telegram from Col. Cole, did you read it to any one?

A. I carried it directly to Mr. Doud, who was then the company's superintendent.

Q. Did you receive from Mr. Doud any reply?

A. He wrote me a letter in conformity with the spirit of that telegram and letter, exhibited as No. 1. He wrote it while I was in his office and handed it to me.

Q. Mr. Gordon, after the work was accepted there is an item in your account of $1,194.50 for extra material furnished. State what you know about that.

A. There was a large quantity of material which Mr. Doud ordered from me in his office, and the order I sent home. We have some letters here referring to them, but I do not know that the quantity as stated there is the quantity ordered from me. There may have been some ordered subsequently, but a considerable quantity was ordered from me.

Cross-examination by Judge TOMPKINS:

Q. That material was furnished for the furnaces?

A. I say that the order was given me and I sent it home to be furnished, but I never saw it at the furnaces, and I do not know that it was received. I understood that it was for the furnaces.

Q. For what purpose?

A. For the repair of "A" furnace.

Q. Were any material- furnished except for the repair of "A" furnace?

A. I think there was something extra for "B" furnace, such as tuyere arches, etc. I cannot remember the details.

94 B- Mr. WHITE:

Q. Did you carry that telegram from Col. Cole to Mr. Doud?

A. I did, to his office. He then wrote the letter while I was in his office.

Q. Did you dictate that letter?

A. No, sir; not one word.

Q. You did not discuss the matter contained in that letter, did you?

A. Not one word.

FRED. W. GORDON.

The intervenors here rested.

(*Witness identifies and presents the original demand for payment as prescribed in contract marked Exhibit 2.)

95 (*Copy of Telegram Sent Aug.* 17, 1888.)

AUG. 17, 1888.

Received at 3.55 p. m.
Dated Nashville, Tenn.

To Gordon, Strobell & Laureau, Tuscumbia :

On reading the contract you will see that our company left the matter of accepting the work entirely with the superintendent, E. Doud. The matter of accepting the work is not left with the president. Doud's acceptance of the work will be in conformity with the contract.

E. W. COLE, *Pres't.*

(EXHIBIT NO. 1 TO GRAY'S DEPOSITION.)

Sheffield & Birmingham Coal, Iron & Railway Company, furnace department, E. Doud, sup't.

SHEFFIELD, ALA., *Aug.* 18, 1888.

Messrs. Gordon, Strobel & Laureau, Philadelphia, Penn.

GENTLEMEN : The undersigned, superintendent for the "furnace department" of the "Sheffield & Birmingham Coal, Iron and Railway Company," the said company being successors to "the Alabama and Tennessee Coal and Iron Company" of Alabama, hereby notifies you that he has inspected and does now accept the plant of three blast furnaces erected by you at Sheffield, Alabama, as being and having been completed on the eight- day of August, 1888, in full compliance with the terms and conditions of a certain contract entered into by and between your company and the said "Alabama and Tennessee Coal and Iron Company," dated Feb'y 9th, A. D. 1887, providing for the construction of the aforesaid plant of three blast furnaces.

Very truly yours,
SHEFFIELD & BIRMINGHAM C., I. & R'Y CO., FURNACE DEPARTMENT,
By EDWARD DOUD, *Sup't.*

96 A. B.

Office of Sheffield & Birmingham Coal, Iron & Railway Company.

NASHVILLE, TENN., *August* 18, 1888.

Fred. W. Gordon, Esq., Sheffield, Ala.

DEAR SIR: I am in receipt of your esteemed favor of the 17th instant. I trust my telegram to you of yesterday evening to Tuscumbia with regard to Maj. E. Doud receiving the work was satisfactory.

I have written to Mr. Chamberlain and quoted the last part of

your letter to me, and asked him to co-operate with you in the trial of the use of the Townley coal in the furnace raw.

I trust the mixture of ores will prove reasonably good. I have heretofore written to Maj. Doud to use as little of the Lawrence Iron Company ore as he could with the circumstances surrounding him, but Mr. McLanahan is putting in jiggers and will do a great deal towards cleaning this ore. The West Nashville Furnace Company is using this ore and Tracy City coke, and I think are pretty well pleased with the iron they are making. I do not hear any complaint.

It would be a presumption in me to advise you about blowing a furnace, but it occurred to me it would be well to increase its output gradually to a reasonable output and hold the furnace at that, not using more power than she will have when the other two are blown in.

Hoping for the best, I am,

Yours truly, E. W. COLE, *Pres't.*

*Evidence and Exhibit of Fred. W. Gordon. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

97 FRANK W. GORDON re-examined for plaintiffs.

Direct examination by Mr. GUNTER:

Q. You are one of the plaintiffs?

A. Yes.

Q. Did you submit plans and specifications in behalf of the plaintiffs to the Alabama & Tennessee Coal and Iron Company for the erection of furnaces in question?

A. Yes.

Q. State whether or not any experts considered those plans and specifications on behalf of the parties to whom you submitted them.

A. Major Doud and General Willard Warner did.

Q. Did they talk to you about them in behalf of the contracting parties?

A. Yes; the more pungent question came from them.

Q. Are they competent and skillful experts?

A. Yes; in my opinion.

Q. Did they make any alterations?

A. Yes; and then altered them again.

Q. And they are the ones now submitted?

A. Yes.

Q. You made the contract there shown?

A. Yes.

Q. Did you erect the work in pursuance of that plan?

A. Yes.

Q. State whether or not the work was inspected during its progress.

A. I understood it to be done every two weeks. I got pay every month.

Q. Did you get your pay up to and after the inspection?

A. All the work was done upon ninety per cent. of the value of the work as done, but during the inspections we were paid in part upon materials and part work done.

Q. State what test you applied to these engines, if any, showing their strength and capacity.

A. I ran the engines at eight or nine pounds pressure. I have forgotten what they realized. I do not remember what pressure was used at sixty revolutions.

Q. Did you not make tests of the same plan of engines elsewhere?

A. We have one like it, all except the blowing cylinder.
98 The blowing cylinder was one-third of this in area, and that was equal to ten pounds pressure on this. The engines were alike in every detail, and we ran that up to eighty-five revolutions per minute; commonly at seventy to seventy-five.

Q. State to what extent the test upon the engine proper, leaving out the blowing cylinder, that you gave to that one like this exceeded the sixty revolutions and ten pounds pressure.

A. I could not state that unless I took into consideration the blast pressure.

Q. Was it the same or greater than the ten pounds pressure upon this cylinder and forty-five revolutions?

A. Very much greater.

Q. The pressure upon the blowing cylinder represents the duty put upon the engine?

A. Yes.

Q. And that engine, just like this, having a blowing cylinder of one-third the area of that in this case, had three times the pressure of ten pounds per square inch on this cylinder?

A. Yes; and it was perfectly satisfactory.

Q. What is your opinion of the capacity of these particular engines to stand a speed of forty-five revolutions per minute and a pressure of ten pounds per square inch?

A. They are perfectly ample.

Q. Are they proportioned as to weight to stand hard work?

A. Yes; every part was carefully calculated in detail.

Q. What is the weight of the moving parts of these engines?

A. Thirty-two and one-half tons.

Q. Would a pressure of ten pounds upon the blowing cylinder be sufficient in running an engine at any speed with no lead?

A. The area of that blast cylinder is 5,541 square inches; ten times that would be 55,410—that is, pounds lifting; putting the weight of the moving parts at 65,000 pounds it would lack 10,000 pounds of lifting the moving parts; without the assistance of a large lead or compression in the steam cylinder the parts would not be lifted.

Q. Would a pressure of ten pounds upon the blast cylinder of these engines at forty-five revolutions lift the moving parts?

A. No.

Q. And in such case state whether or not the caps upon
99 the main shaft could be moved with safety.

A. Yes; in such case if those conditions were kept up.

Q. State to the court as shortly as possible whether or not water could be carried over with the steam from these boilers unless carried too high in the boilers?

A. I do not believe that it could unless it was foaming in the boilers. If foaming in the boilers it could be detected and shut off.

Q. If those boilers were managed properly by competent engineers would water go over?

A. Not to an injurious extent; two or three per cent.

Q. What is the effect of water going over into this cylinder?

A. It produces a water hammer, which is an incompressible substance between the steam piston and the head on the bottom or top; more likely on the bottom.

Q. What is the effect of the water hammer on the running of the engines?

A. It produces the most severe strains that engines are subject to. If the engine is running fast and the water in it is above the right quantity it will break the strongest engine in the world, for the reason that the water being incompressible, the fly-wheels being very heavy, the speed is multiplied by the water very greatly, and, the center having been nearly released, the toggle action or joint is brought into play. This action is the most powerful in mechanics and is only limited from infinity by the filling of the rolling joints, which in well-constructed engines is reduced to a minimum by careful machinery and construction, and all this power applied in this way will produce a force practically irresistible.

Q. Where would the effect of that force be shown?

A. First, in the parts nearest to where the force is applied; the resistance comes from the piston; the greatest force is directly at the shaft; that will, if the water is in the lower end of the cylinder, which is the most likely place for it when the engine is in action and the caps screwed down, it will lift the shaft and break
100 the cap or bed plate. If the caps are loose the strain will be from the engine and the shaft will lift; the center will then be pressed down, but, owing to the velocity of the fly-wheel, the shaft will be thrown back into its seat with great violence, which will produce a blow according to its velocity and the weight of thirty-two and a half tons.

Q. State in general terms whether any bed plate could withstand the continued and repeated shocks arising from these water hammers.

A. I would state that I do not believe it can, because I have known of so many being broken.

Q. Could it be likely broken in any other way?

A. Not without that cause.

Q. State how these foundations were solid and sufficient.

A. I was not there during the entire construction. I saw them during construction and after they were constructed, and so far as I saw they were as well done as brick foundations could be, and

the bed plates were put well upon them and they were then running what we call rust joints.

Q. How could the top in the piston head in the blast cylinder be broken? If the engine was subjected to these strains what would be the effect upon this piston head?

A. It is about two tons or two and a quarter tons weight. The rod is fastened into the head by first being tapered low into the head and turning the rod to fit with a tap one-sixteenth of an inch, and now a large nut is screwed on to keep it tight. If the steam is admitted very suddenly while there is no resistance on the blast piston, it is like the blow of a hammer. The rods and the piston heads are comparatively light, though a pressure of eighty pounds upon the steam piston has the force of eighty-one thousand pounds in the act of coupling up; this is a positive blow, and as no joints are ever absolutely rigid that blow would be received entirely by the head. This forty-ton blow would be very likely to split a very strong one. This wrong setting of the valves causes the shocks, which would jar that head continually every thirty min-
101 utes. Those jars are totally different from those of the water hammer.

Q. Do you think those jars caused from the regular running are sufficient to break that head?

A. I do.

Q. State whether or not these engines are as heavy as engines of that size usually are.

A. I think so.

Q. What is the character of Weimer?

A. He builds more engines than anybody in the country.

Q. Do you know the weight of his engines?

A. No.

Q. How do these boilers compare with other boilers?

A. I believe them to be more effective steam-raisers than any other.

Q. How would they compare with any other heating surface, being equal?

A. Very favorably.

Q. With reference to these steam valves in the steam mains, state whether or not the valves in the steam mains would be a proper addition to this plant.

A. No; I think not.

Q. How do those leaks occur, do you think?

A. By the exposure of the pipes to the weather and the rapid expansion and contraction.

Q. How long would it take a machinist with proper pains to correct one?

A. Half an hour.

Q. In reference to the pumps, state whether any additional valves or any independent connections would be necessary in the full operation of this plant.

A. No; I never heard of such a thing.

Q. How is the steam for the pumps usually obtained?

A. By connections with the steam mains, always.

Q. In reference to these bridges, what have you to say on that? Did the plant call for such a thing?

A. No.

Q. Are they necessary?

A. No; because every furnace is supplied with its own hoisting apparatus.

Q. Could it supply two furnaces?

A. No; the hoisting capacity of these hoists is not sufficient for the material for two.

102 Q. Suppose a man has one furnace, how many hoists will he have?

A. Never more than one.

Q. What would he do if it should break?

A. Wait till he repaired it.

Q. Did you ever hear of a furnace being constructed with two hoists?

A. I never did.

Q. What do you say about the propriety of connecting all the stoves with pipes?

A. I think it was a foolish arrangement. Neither myself nor anybody I ever talked to on the subject knew how to make expansion joints for a long line of the hot main.

Q. Looking at this plan as a whole, did you ever see one more complete in all its parts and arrangements?

A. No; there is no better in the United States.

Q. State whether or not you are acquainted with the proper rules and formulas for burdening a furnace.

A. I have read all the best authorities on the subject and have studied it very carefully, and I have applied the rules to other furnaces.

Q. Do you consider yourself competent to blow in a furnace?

A. Yes; I have had experience in it.

Q. Were you furnished with an analysis of the materials that were to be put in furnace A?

A. With an analysis of the ores and limestone.

Q. Taking those analyses as representing the ores, state whether or not your formula was correct.

Q. I am absolutely positive that it was. I have my original figures, and I have gone over them and I cannot discover an error in them.

Q. To what do you attribute the failure of furnace A?

A. I attribute it to the fact that the ores were not what they said they were and we had a very severe rain-storm at the beginning of the blowing in, while we were very cold, and to the improper charge of the furnace, owing to the sleeping of the men and the

103 general inefficiency of help about the plant.

Q. Was Major Dowd there at any time?

A. Yes; I consulted with him.

Q. Did he approve your suggestions?

A. He approved of all my suggestions, in my recollection.

Q. We come now to furnace B. You then undertook to blow in furnace B. How did that succeed?

A. I never had a more successful blow-in. After it was blown in there were some difficulties. The furnace gobbed with lime in the bottom, and we had applied the Jasper coke, and the furnace was then cool from the effect of it, and at that time we had to encounter a rapid succession of boils in the cast-house, which compelled us to stop operations. The effect of stopping was to cool it off and deposit more and more lime.

Q. Did you discover what was the matter?

A. Yes; I discovered that, although we had used the second set of analyses, we still had too much lime, and we had to reduce the lime, and we did so as rapidly as we could. We could not deny the accuracy of the analysis; it had to be forced upon us, and I had reduced the lime about fourteen or fifteen per cent.

Q. About that time what occurred?

A. We had this rapid succession of boils and had to stop the furnace when it was absolutely essential to keep it going, and our men were running away on account of the yellow fever.

Q. Did you have anything to do with the procurement of the sand?

A. I did not.

Q. And you were then relieved?

A. Yes; by a letter from Mr. Tompkins.

Q. The defendant- refused to deliver you the notes provided for in the contract for the balance due?

A. Yes.

Q. When was the demand and their refusal, if there was any?

A. I cannot call to mind. It was during the latter part of September. In fact, we made an informal demand before that.

104 Cross-examination by Mr. WHITE:

Q. These engines are made after a design and plan of your own?

A. Yes; six were built by the Lebanon Manufacturing Company.

Q. You submitted those engines to different manufacturers for propositions?

A. I think so.

Q. Are these made after the same plan?

A. Yes.

Q. Did you submit them to an engine-maker at Columbus, Ohio?

A. I do not remember. I do not think we did.

Q. You do not remember that you submitted them, and that they declined because they were too light?

A. They never were submitted to Todd and Company.

Q. If they were submitted they were finally made by those plans?

A. I do not know. I cannot tell whether they were altered or not.

Q. You made the drawings for yoor engines?

A. Yes.

Q. And they were submitted to some different manufacturers?

A. Yes; there — drawings made at our office of different engines, quite a number for different purposes, and we might have submitted one of those to Todd & Company, of Columbus, but not these.

Q. These engines were built by the drawings that you did submit to the different manufacturers?

A. Yes.

Q. Then if these men did consider these drawings these were the ones?

A. Yes.

Q. But you do not think that these were submitted to them?

A. I am quite certain.

*Deposition of Fred. W. Gordon. Filed in Clerk's Office July 19th, 1890.*
*A. W. McCullough, Clerk.*

105 FRED. W. GORDON recalled for complainants.

By Mr. GUNTER:

Q. What is the area in these valves for the discharge of air from the blast cylinder to the blast main?

A. It is the circumference of this opening multiplied by the heights which this lifts (indicating), which, carefully measured, gives an area of five and one-half inches given by the lift, and it has a greater area surrounding the edge of the valve—that is, the smallest area of the brass valve. The improved valve's narrowest area is around the periphery of the valve. As the valve rises *and* the air has passed around the periphery to discharge into the main and passes into the furnace. This area is 4.7 sq. in.

Q. The improved valve testified to by Mr. Massey has, then, a smaller area for the discharge of air into the blast main that the brass valve by what per cent.?

A. About 17%.

Q. What amount of pressure in the blast cylinder does it take to lift these brass valves?

A. Estimating the valve at 11 oz., the total power required to lift all the valves would be thirty pounds.

Q. What would that be per sq. in. on the blast cylinder?

A. About $\frac{1}{20}$ lb.

Q. What would the improved valve require?

A. I have not estimated the weight of this valve, but I do not think it would weigh but half as much, and would be about $\frac{1}{1^1_2}$.

Q. Then the difference between the two would be a saving in pressure?

A. Yes, sir.

Q. About how much would that be?

A. About $\frac{1}{40}$ lb. per sq. in.

Q. What difference would that make in the revolutions of the engine?

A. It would certainly make some difference if everything was

alike, but a very slight variation in the setting of the steam valves, and an imperceptible variation in the pressure of the steam would compensate for difference in the power required to lift these valves, and there is no instrument so delicate as to be able to test that slight difference. Practically it would not make to the senses any
106 difference in the speed of the engine. I believe that a difference in the area of the most contracted portion of the outlet would cause actually greater resistance than the difference of the weight of the valves, so that an engine with brass valves, everything being equal, both being constructed as in this case, would run fastest.

Q. In reference to these *guages* of pressure at the bustle and at the engine, do they indicate at all the actual volume of air that goes into the furnace?

A. In no sense whatever.

Q. Is there a way to determine the actual blast that goes into a furnace?

A. There is.

Q. What is that?

A. That is determined by having an actual average analysis of all solid materials that go into the furnace and an average analysis of all gas that issues from the furnace. From that it can be actually calculated the quantity of blast that enters the furnace.

Q. How does that show the actual blast?

A. Mainly through the quantity of nitrogen that is found in the escaping gases from the furnace.

Q. The nitrogen which goes in as air is not consumed?

A. No.

Q. Then, if you know the quantity of nitrogen that comes out, you know the quantity of blast that goes in?

A. Yes; not only that, but you can determine the quantity of carbon that is consumed by the blast and the quantity that is consumed directly by the oxygen of the ore.

Q. If the furnace is incandescent, is it possible that a greater blast is in that furnace than will be consumed?

A. The carbon in the hearth is in a highly incandescent state and the quantity of atmospheric air that enters that is in the exact proportion to the quantity of carbon that is consumed in the hearth, and the measure of carbon that is actually consumed in the furnace is measured the largest quantity blast that can possibly enter the furnace. I say the largest quantity of blast because the per cent. of carbon that is burnt by the oxygen of the ores is not always the same. It will vary in practice from five to 16 & ½%.

Q. But, if you know the quantity of carbon consumed, and you can get that by computing the quantity of coke used, you know the blast which has gone through the furnace?

107 A. You know the greatest quantity that can possibly go through.

Q. Did you ever see a furnace in operation which showed apparently the consumption of a greater amount of blast than it

should, and which, upon investigation, was accounted for otherwise?

A. I have.

Q. State what it was and how it was.

A. It was found that leaks existed; the engine valves or the air cylinder or the valves of the hot blast or some other inaction was leaking the blast away, and the engine was laboring to produce that the furnace did not receive.

Q. What is the proportion of limestone that ought to be put into the silica relatively in burdening a furnace?

A. That depends upon the analysis.

Q. You would have to know the analysis of the limestone to know what portion to put to the silica?

A. Most assuredly.

Q. What is the danger of too much silica in a furnace?

A. It will cut the furnace brick very rapidly if the lime is too low, and if the lime is too high it will fill up the furnace hearth.

Q. Is there *is* any such rule which would justify putting in 250 lbs. limestone to 125 lbs. silica?

A. It is a very common rule to use a sort of multiple that way; it is a very ready way, but it is a very improper rule, and only admissible after practical experience with the ores in use; after experience is practiced with certain ores, then the furnace can be operated; all the conditions must be understood in advance that the furnace may be charged properly, and no impracticable rule can be employed properly.

Q. In burdening these furnaces that you blew in did you go by any settled rule?

A. I designed that the silica should be 38 % of the slag and that the lime in the slag should be 46 % and the alumina should be 12 to 13 %; these proportions I knew from experience would produce a very fusible and very easily managed slag.

Q. Did you run it scientifically as well as by experience?

A. The science of slags has not been fully investigated, and at just what temperature slags will flow readily is not very well
108 known. These conditions are best arrived at by analyzing the slags.

Q. If the analysis of the ores and other materials had been such as were given you, would that have been the constituents of your slag?

A. Exactly.

Q. In operating boilers state how many cocks these Babcock boilers have?

A. Three try-cocks and glass *gua*ges about 4 in. apart.

Q. In operating one of these boilers where is the point to have the water—what is the rule?

A. The rule is that water and steam should issue from the centre try-cock, showing that the level of the water is at the centre try-cock; the purpose of this is that if the water, by too rapid movement of the feed-pump, should arise there will be time enough to

notice that rise before it reaches the top cock; the same may be said as regards the lower one.

Q. What amount of water is required, in your opinion, to raise the water from where it should be carried in the center until it gets to the top of the top cock?

A. It is about 30 cubic feet to each boiler.

Q. Does one pump operate for each boiler?

A. No; it is intended that one pump should supply four boilers.

Q. Then the water has to rise in all?

A. In four boilers

Q. How many barrels of water do you think it would take to raise the water from the proper level up to the top cock?

A. About six barrels to each boiler; in four boilers this would be 24 barrels; this operation is controlled by the speed of the pump and the regulation of the valves to feed the water.

Q. What is Mr. Doud's reputation among ironmen as an expert in making iron?

A. I do not believe I could answer that question, because I never spoke to any ironman about his reputation.

Q. Do you know anything about him as to his competency?

A. So far as my knowledge of him, I consider him a very superior ironman; I have come in contact with him a good deal.

By Mr. WHITE:

Q. Did you furnish these leather valves?

A. I did for one engine, and also the brass valves for the same engine.

109 Q. But you did not furnish the leather valves for the engines after the furnace begun operations?

A. No, sir.

Recalled.

By Mr. GUNTER:

Q. Are you a manufacturer of engines?

A. Yes, sir.

Q. Have seen many?

A. A great many.

Q. What does a cubic foot of iron weigh?

A. About 430 pounds.

Q. Are you accustomed to weighing engines?

A. Yes; we always — everything we get.

Q. You can tell very well by looking at machinery what its weight is?

A. No, sir.

Q. Can any man?

A. No, sir.

Q. What would be the proper relative increase of the weight of an engine from a 36-in. cylinder to a 42-in. cylinder?

A. Based upon a steam pressure of the same amount, which is

the custom with manufacturers, the force derived from a 42-in. cylinder would be just 25% more than the force from a 36-in., and, as a manufacturer, I would say that an engine would be exactly 25% heavier for a 42-in. than a 36-in. The 42-in. cylinders are usually constructed for anthracite practice, which requires more pressure than common practice.

By Mr. TOMPKINS:

Q. Have you seen any of these engines that Mr. Chamberlain mentioned with an 84-in. blast cylinder?

A. I have seen the Weimer 36 to 42 in., with 84-in. blowing cylinder.

Q. With a 4 & ½ foot stroke, how much does that engine weigh?

A. I do not know the weight of any of them. It makes a very great difference whether an engine has a four-foot or 4¼-ft. stroke.

(By the COURT:) When respondents closed their evidence-in-chief they gave notice that they desired to either examine D. A.
110 Tompkins orally or to have his deposition taken during the progress of this case. Respondents now move for leave to take his depositions, and leave is granted by the special master. The evidence in this case is closed, with the exception that Mr. Tompkins' depositions, when received, will be read in evidence, and with the further exception that the intervenors will be allowed to offer evidence in rebuttal of the same, if they think proper. This 28th September, 1889.)

Testimony of F. W. Gordon. Filed in clerk's office July 19th, 1890. A. W. McCullough, clerk.

111 *Rowell. Filed in Clerk's Office July 19th,* 1890. *A. W. McCullough, Clerk.*

(Copy.)

112 SATURDAY, *September 21st,* 1889.

(Defendants object to any testimony in rebuttal of proof of allegations in cross-bill.)

GEO. A. ROWELL sworn for complainants:

Q. What's your name?

A. Geo. A. Rowell.

Q. Where do you live?

A. In Brooklyn, N. Y.

Q. What's your business now?

A. I am employed by the Babcock & Wilcox Co.

Q. To do what?

A. I have charge of the erection and setting up of boilers, and also the inspection of them after they are up.

Q. How long have you been engaged in the business in connection with boilers?

A. Twelve years.

Q. Did you have any experience before that in connection with machinery?

A. I have been connected with machinery since I was sixteen.

Q. What's your age now?

A. Thirty-nine.

Q. Did you spend any of your time in connection with blast furnaces?

A. I have about two and one-half years.

Q. Are you acquainted with the general construction of boilers and the efficiency of boilers for making steam and running engines?

A. Yes, sir.

Q. What, in your opinion, is the most economical, safest, and efficient boiler now in use in the United States?

A. In my opinion the Babcock & Wilcox are better than any other boiler that I know of.

Q. Do you know what sort of boilers were put up by Mr. Gordon's firm for the defendant in this case?

A. Yes, sir.

Q. What sort of boilers were they?

A. The Babcock & Wilcox.

Q. What was the heating surface and horse power of these boilers?

A. The heating surface was 21,480 ft., and we rate it at 1,872 horse power.

Q. That was for all of them?

A. Yes, sir; twelve of them.

Q. Each boiler was how much?

A. 156 horse power.

113 Q. What was the heating surface of each?

A. 1,790 feet.

Q. The rating of the horse power—is that maximum, or how is that?

A. It is the rating which we consider would give the best results at the most economical combustion.

Q. State whether or not the actual power of the boiler is in excess of that.

A. The boiler can be made to develop much more than that.

Q. State whether or not, if you know, in blast-furnace practice it is not usual to develop in the boilers more horse power than you rate them at.

A. That has been my experience.

Q. Were you ever at these furnaces while in operation?

A. Yes, sir.

Q. How often?

A. Once.

Q. When was that?

A. About the first of November, last year.

Q. Did you see anything then tending to show improper management of these boilers, so far as getting out their efficiency was concerned?

A. I did.

Q. What did you observe?

A. I observed that the heating surface was very dirty, indicating that they had not been kept clean by use of the steam jets. There were no glass *guages* on the boilers to indicate the height of the water. At the time of my visit I tried the try-cocks and found the boiler full of water and above the top cock.

Q. The try-cocks are *guages* that determine how high the water actually is in the boilers?

A. Yes, sir.

Q. If the boiler is too full of water what is the result as to the power of steam to be developed? Is it less or greater than if it was at the proper height?

A. If it is too full it will not develop as much steam.

Q. If it is too full state whether or not the water would flow over into the engines.

A. It would.

Q. When it goes above the top try-cock and there are no glass *guages*, can you tell how full it is?

A. No, sir; not when it is any distance above them.

Q. Could you tell how high it was above the top try-cock in
114 this instance?

A. I could not.

Q. They might have been very full?

A. There is nothing to indicate how full they were.

Q. The flow of water out through the engines, then, would result from the boilers being too full of water?

A. It might; yes, sir.

Q. Did you warn the people in charge or give them any direction about the management of these boilers?

A. I complained that there were no glass *guages* and warned them that they would likely have trouble from that cause.

Q. Glass *guages* would be simply to show how high the water is. Is that so?

A. Yes, sir.

Q. All good engineers know the proper height the water should go in the boilers?

A. Yes, sir.

Q. In reference to the heating surface, your boilers are constructed by a great number of 4-in. tubes, in which the water is contained and around which the flame of fire plays?

A. Yes, sir.

Q. Then the flame acting on these four-inch pipes in the process of time covers them up with a cinder or carbon of some sort?

A. There is a black soot deposit when coal is used, and the blast-furnace gases deposit a white dust.

Q. And the effect of these formed on the outside of these tubes is to make the heat less effective upon the inside of the tubes?

A. It prevents the absorption of the heat by the water inside.

Q. Then, to obtain the proper capacity of the boilers it is necessary at stated intervals to wash all these tubes with a jet of something?

Q. Did you have any experience before that in connection with machinery?

A. I have been connected with machinery since I was sixteen.

Q. What's your age now?

A. Thirty-nine.

Q. Did you spend any of your time in connection with blast furnaces?

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Q. The rating of the horse power—is that maximum, or how is that?

A. It is the rating which we consider would give the best results at the most economical combustion.

Q. State whether or not the actual power of the boiler is in excess of that.

A. The boiler can be made to develop much more than that.

Q. State whether or not, if you know, in blast-furnace practice it is not usual to develop in the boilers more horse power than you rate them at.

A. That has been my experience.

Q. Were you ever at these furnaces while in operation?

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Q. How often?

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A. It would.

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A. No, sir; not when it is any distance above them.

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A. There is a black soot deposit when coal is used, and the blast-furnace gases deposit a white dust.

Q. And the effect of these formed on the outside of these tubes is to make the heat less effective upon the inside of the tubes?

A. It prevents the absorption of the heat by the water inside.

Q. Then, to obtain the proper capacity of the boilers it is necessary at stated intervals to wash all these tubes with a jet of something?

A. With steam or water.

Q. Are your boilers prepared with this arrangement?

A. Yes, sir.

Q. To what extent do you think a thick coating upon these pipes would make in the development of the capacity of these boilers between one that was kept clean and one that is dust-coated?

A. I have seen a coat of dust thick enough to cut down the capacity of the boiler one-half.

115 Q. If other boilers are used don't they have to be cleaned outside and inside as well as these?

A. Yes, sir.

Q. Are the Babcock & Wilcox boilers more difficult or easier to clean than other boilers?

A. They are easier to clean.

Q. Can you state whether or not the Babcock & Wilcox boilers, such as are used here, are used in the best managed iron establishments in the United States or a great many of them?

A. They are used in a great many of them.

Q. Are they used, so far as you know, by men that are capable of judging of their efficiency?

A. I think they are.

Q. Do you think they give any trouble, that you know of, so far as their capacity and efficiency is concerned?

A. Not to my knowledge.

Q. What knowledge have you of the extent of the use of these boilers?

A. They are used in almost every State in the Union and nearly every country in Europe.

Q. You say there is a given number of square feet of heating surface of the Babcock & Wilcox boilers and the same surface in a modern tubular boiler. State whether or not the capacity of the Babcock & Wilcox boiler or of the tubular boiler will be the greater.

A. The Babcock & Wilcox boiler is fully equal to any tubular boiler.

Q. Is it equal to any other boiler that is used in blast furnaces?

A. So far as I know it is.

Q. Do you know anything of the consumption of gasses as a fuel and the management of it under boilers?

A. I know something.

Q. State whether or not there is any skill to be exercised in the proper use of gases escaping from the top of the furnace as a fuel.

A. There is.

Q. State whether or not under different circumstances the same amount of gas will be more or less efficient; state what operates on that.

A. A proper amount of gas is more efficient than an excess.

Q. Can you explain how that is?

A. A certain amount of gas is admitted into the boiler.

116 This requires a given amount of air to properly consume it, and the resulting product will be the highest degree of tem-

perature that can be obtained, but if you admit too much gas you not only will not consume any more from an insufficient air supply, but this excess of gas will dilute the amount which is being burnt, thereby lowering the temperature.

Q. The gases are forced in by positive pressure from the furnaces?

A. Yes, sir.

Q. Would not the gases if forced in take the place of the air to the same extent, which should be drawn in to furnish the proper amount of gases?

A. Yes, sir; it would under those circumstances.

Q. The diminution of the gas supply in that way would show its effect upon the reduction of heat in the boilers?

A. Yes, sir.

Q. And that reduction is the power of the engine?

A. Yes, sir.

Q. Do you know of any case altering this matter?

A. I know of one—the Byrd-Coleman furnaces, in North Cornwall, Pa.

Q. Explain how that is.

A. With the draft damper wide open a large amount of gas passes through the boilers so rapidly that it did not have time to properly mix with the air and burn. Closing the damper to one-fourth its original opening would result in an increase with a very much less amount of gas used.

Q. Did you actually see that yourself?

A. Yes; I saw it with the damper opened and closed. I could see that the conditions inside were more favorable for the production of steam closed to one-fourth its original opening.

Q. You say there is skill required in burning the gases under the boilers?

A. Yes, sir.

Q. State whether or not there are positive scientific ways of determining whether or not the engine is using water from the boiler.

A. There is.

Q. Can you explain that?

A. I should take an indicator and measure the amount of steam passing through the cylinder, as shown by the indicator, and the contents of the exhaust; take the temperature of it and
117 weigh it. From that you can tell the amount of heat absorbed from the steam at the pressure at which it entered the cylinder. If none of the wet atmosphere of the exhaust accounts for this difference it will show that there is no water entered in the steam. If there is more water than the condensation of a proper amount of steam would indicate, then the steam has carried water with it.

Q. There are still other plans, are there not?

A. Yes.

Q. State whether or not these scientific appliances were applied to the Babcock & Wilcox boilers to see whether or not they would operate partly to indicate whether or not water was carried over.

A. I have had very many tests made of that.

Q. With what result?

A. They have never shown but a very small percentage of moisture; practically dry steam in every case.

Q. That was when the boiler was filled with water to the proper height?

A. I would not make the test under other conditions.

Q. Can you indicate what other plans there are for making this test?

A. There is an instrument known as the calorimeter for measuring the quantity of moisture in steam; several forms of them. It can also be shown by an indicator diagram.

Q. Are all these tests sufficiently accurate for all practical purposes?

A. They are.

Q. They are known to all well-informed engineers, are they not?

A. Yes, sir; they have been in use for several years.

Q. Without these appliances could you tell anything about the water being used in the engines from the mere condition of the exhaust?

A. I could not from the exhaust.

Q. Is not the operation of an engine in getting the effective power out of steam and then passing the steam through the heater to transform the steam into water?

A. It does transform a certain amount into water.

Q. A perfect heater would transform into water so that nothing would come out the exhaust except water?

A. Yes, sir.

Q. The fact, then, that water issues from the exhaust is no evidence whatever that then — is itself using water?

A. No, sir.

118 Q. If water did not pass from the exhaust would not that itself indicate that the engine and heater together were operating badly?

A. That they were not properly proportioned or something wrong.

Q. If difficulties were encountered in raising steam with the escaping gases, and if the gases burnt at the top of the furnace stack sometimes, state whether or not it would be proper to have an analysis made of the gases which enter the smoke-stack to see whether or not a proper mixture of gases and air had been made.

A. I do not know of any other way of determining whether or not a proper mixture had been made, though it is not very frequently done in practice.

Q. But under extreme difficulties it is?

A. Yes, sir.

Q. If the gases were burning at the top of the stack and not enough steam being made what would that indicate?

A. To me it would indicate an excess of gases and a small supply of air at the point where it enters the boilers.

Q. Under these conditions if you apply coal under the boilers what would be the result?

A. You would have to admit air to burn the coal or you could not burn it.

Q. If coal were applied when there was an excess of gas unconsumed in passing over it would the coal be properly burnt?

A. No, sir; not with an excess of gas.

Q. To what gas would it be burned?

A. Carbonic oxid if there is heat enough to burn any gas, but if there is complete combustion it would be carbonic acid.

Q. What is the difference in the relative quantities of heat evolved from any burning substance between the production of carbonic oxide and carbonic acid?

A. I cannot give you the exact number of degrees, but in general, with a proper amount of air, carbon burns to carbonic acid at about 4,500 degrees, and to carbonic oxide at about 1,500 degrees.

Q. State whether or not you examined the setting of these boilers.

A. I did.

119 Q. If the water was carried over from the boilers to the engines and there worked with the steam in any quantity state what effect it might have in breaking the engines.

A. If it was carried over in sufficient quantities it might break.

Q. Explain how.

A. Water is incompressible, and if it were present in the cylinder in any quantity, as the piston approached the end of the cylinder, the water, being unable to escape fast enough and relieve the pressure, the shock would be likely to break the cylinder head.

Q. Or could it not exert a lifting force on the shaft?

A. Yes, sir.

Q. And in that event might break the cap holding down the shaft?

A. Yes, sir.

Q. Or might break the cylinder itself?

A. Yes, sir; might press the head out.

Q. Suppose water is brought over in considerable quantity, could it flow off if the escape cocks were kept open?

A. The escape cocks, as they have here, are not sufficiently large to carry off any quantity of water.

Q. In such cases, then, the water, coming over in considerable quantity with the steam, would form a cushion, upon which the piston, going up and down, would strike?

A. Yes; it would form a solid mass upon which it would strike.

Q. While you were at the furnaces in question did you give them any caution about the effect of having too much water in the boilers?

A. Yes; I told them that if they continued to run without glass guages they were liable to carry the water too high and carry the water over into the engines and break them, or too low and break the boilers by burning them.

Q. Did you find the water in the boilers at that time too high or too low?

A. I found it too high in the battery that I tested.

Q. You didn't know how much too high?

A. No, sir.

Q. Looking at these boilers as they were then managed and in the condition that they were, how did the management compare with that which they ought to have received and that which
120 is generally bestowed upon boilers by competen- persons who are in charge of them?

A. Compared with other boilers that I have seen, they were apparently very badly handled and abused. I do not know that I have seen a set of boilers of that size that seemed to have less care.

Q. Have you seen much of blast furnaces?

A. I have seen a good many.

Q. Looking at these boilers and what you have seen of the operations of boilers at other furnaces, state whether or not, in your opinion, twelve boilers were capable of running those three furnaces.

A. From the operation of other furnaces that I have seen I should consider that they were capable of running the three furnaces.

Q. Is there any difference between running one furnace with two batteries and three furnaces with six batteries, so far as regards economy of steam?

A. Yes; there is.

Q. Explain to the court what that is, and how.

A. In the use of steam for blast furnaces and other plants there is a certain fluctuation in the amount of steam generated and the amount of steam used for the same operation. If you should connect three furnaces onto six batteries the fluctuation would be averaged, so that the general result would be much in favor of connecting the three.

Q. By fluctuation you mean this, do you not: That one battery at one given time produces a given quantity of steam and at a subsequent time it might produce more or less, while the same thing might be going on with other batteries, and that in that way, if all of them were connected, you would get the benefit of the average high production and the average low production at the same time?

A. That's what I mean.

Q. This fluctuation in production is caused by a change in volume and constancy of the flow of gases?

A. Yes, sir.

Q. And other causes which might operate differently in different furnaces at the same time?

A. Yes, sir.

Q. Is there not another saving by running all the plants together in the way of fixed expenditures? What about the radiation of steam mains, would not that be as great running one as all?
121 A. Radiation is fixed amount under given conditions. I cannot say that the radiation would be any different by running three together and by running one separate.

Q. If there is 300 feet of main pipe that is filled by steam from one battery of boilers, state whether or not the tax upon that one battery of boilers would not be as great as if the steam main was filled by steam from all the boilers.

A. If I understand your question, would the radiation from six batteries through the same amount of steam pipe be any more or any less than if would from one battery through the same pipe? The radiation would be the same in each case, but the percentage of fuel would be much in favor of running all batteries together.

Q. Suppose your radiation has a given valuation $x$ and you run only part of the plant, don't that plant have to cancel $x$ by radiation?

A. You have to charge $x$ radiation against your cost.

Q. If the steam main is filled from 12 boilers at once would not the average of each boiler be less?

A. $x$ would be divided between each boiler, and therefore would be less according to the number of boilers used. What I mean is this: The total amount of radiation in each is the same, represented by $x$. In one case the loss represented by $x$ is charged against a single battery of boilers, and in the other case the same loss, represented by $x$, is divided among six batteries.

Q. In reference to the radiation on the pipes for pumping, *on* in other purposes, state whether or not the same rule would apply.

A. The same rule would apply in every case.

Q. State whether or not the production of waste gases in the furnace fluctuates as well as the production of steam.

A. It does.

Q. Then state whether or not the running of all furnaces together would tend to produce uniformity in the supply of gasse.

A. It would. There would be greater uniformity.

Q. Did you see those boilers that were furnished with those engines?

A. Yes, sir; they were the Babcock and Wilcox boilers.

Q. State whether or not the outfit of these boilers was the usual outfit given by your company for boilers of that character.

A. It was.

122 Q. Do you know what is *the* called the beams for supporting these boilers?

A. I do.

Q. State to the court what they are.

A. The boilers are supported from four channel beams, two at each end, which are placed on top of four eye beams, and the boilers are suspended from these channels beams by means of eyebolts.

Q. State whether or not, in your opinion, those beams are of the capacity and strength for the work of sustaining these boilers.

A. We have found them to be sufficient and have proved them to be sufficient; in my opinion they are sufficient.

Q. Are they the usual size given for these boilers?

A. Yes, sir.

Q. Do you know whether or not other boilers of this size are being supported upon these same beams?

A. They are, upon the same size beams.

Q. Have any of them given way?

A. No, sir.

Q. State whether or not it is usual or customary to make connec-

tions for pumps or other purposes with anything but the steam mains, blast furnaces.

A. It is not customary, so far as I have observed.

Q. Did you see the joints of those steam mains?

A. I saw the steam mains from the joints that were visible.

Q. What sort of joints were they?

A. Flange joints.

Q. State what is the character of flange joints compared with other joints.

A. For large pipes I prefer the flange joints to any other.

Q. Do you know the Usudurian packing?

A. I do.

Q. What character does it sustain?

A. Very high; probably the best used for flange joints.

Q. State whether or not large steam mains of that kind, being exposed to the weather and uncovered, with the rains on them, would be more apt to have leaks in them than if they were covered properly.

A. They would be very apt to leak under those circumstances.

Q. If the joints were properly made in the first instance, with Usudurian packing, and the pipes were properly covered, how would it then be about leaks?

A. If the pipes were properly put up and properly covered they would not leak afterwards, if properly protected.

123 Q. State whether or not in steam mains of that kind it is usual or necessary to have valves in them.

A. I should consider a valve at the end all that was necessary.

Q. Have you observed the construction of steam mains in other plants?

A. Generally, yes.

Q. Have you ever observed steam valves in the steam mains?

A. Never in any steam mains.

Q. Looking at the lithograph of this plant, showing the steam mains from the boilers into the engine-house, with their three connections, suppose that each engine had two valves between the engine and the main, and suppose that between each boiler and the main there was a valve, and suppose that there were valves so that any set of pumps could be taken out and the plant supplied with other set, or that any single pump could be taken out without stopping the supply of water, what other valves do you suppose would be necessary in that steam main and connections?

A. I do not see the necessity for any other valves.

Q. Is there any necessity, in your opinion, for valves along the line of these two steam mains or in their three connections?

A. I do not see that there is any necessity.

Q. Supposing one of those joints in the steam main should get out of order, how long ought it to take a competent machinist, having the proper appliances for unscrewing or cutting the bolts—supposing there are not over eight or ten bolts to the joints, how long ought it to take a competent machinist to undo, spring apart,

and repair the joints and put in new packing and new bolts, if necessary?

A. What's the size of your pipe?

Q. Twelve inches.

A. A man who knew how to do the job well ought to get through it in a half an hour.

Q. Did you examine or survey that plant or its steam arrangements at all?

A. I looked at the boilers pretty thoroughly and some of the engines and the steam-pipe connections.

Q. State whether or not, in your opinion, it was a particular job, or how.

A. It seemed to me to be put up for a good job, and expense was not spared in putting it up and making a first-class job.

124 & 125 Q. Did you ever know of such a thing as a separate engine being made for pumps instead of a connection with the steam mains?

A. I have seen instances where it was required, but not in blast-work, where the mains were not in use during the night and the pumps were, and that required a separate engine, but not in blast furnaces, where the mains are used continuously.

Q. Have you visited many modern blast furnaces in the United States?

A. Yes, sir.

Q. Did you ever see a bridge connecting the hoists of three furnaces 130 ft. apart and 75 ft. high?

A. I never did.

Q. What would you think of the idea of having a suspension bridge 130 ft. long connecting furnaces for the purpose of using one hoist for a different furnace?

A. I should hardly want to give an opinion of that; I have not done the filling enough.

Q. Is there not a scientific method of testing and determining the power and capacity of steam-engines?

A. There is a common way, by means of a steam indicator.

Q. State whether or not that is a thoroughly reliable test.

A. It is.

Q. How does a steam indicator work? Does it make what is called a card?

A. It makes what is called a diagram or card on which is traced a line representing the pressure in the cylinder at each point of the stroke.

Q. Will it indicate the pressure on both places of the piston at the same time?

A. No, sir; not at the same time. The common method is to use two instruments, one at each end of the cylinder.

Q. By using two instruments you can at any time measure the pressure against the piston?

A. Yes, sir.

Q. Will not a full card taken by one indicator represent the pressure during the entire revolution of the engine?

A. It will indicate the pressure on one side of the piston during the entire revolution.

126 Q. That is, on the steam side?

A. Half the time it is on the steam side and half the time on the exhaust side.

Q. Then by reversing the cock or valve you can take with the same instrument the pressure on the other side?

A. You can if the instrument is connected with both ends of the cylinder; that's the common way.

Q. Does not the indicator or its operation show how to set the valves of the steam cylinder?

A. The indicator diagram will show how they are set, and from that the engineer will know whether they are properly set or not.

Q. What's that a diagram for (handing witness a card)?

A. A pair of cards of a steam-engine and blowing-cylinder card. They are diagrams of a steam indicator.

(Attached hereto, marked Exhibit No. 1.)

Q. Will you look at that diagram and see whether the engine making it with a steam indicator was running properly on the steam end of the cylinder?

A. That's what I call a good card. There is no data attached to it showing the conditions, but it indicates a good card. The valves are all properly set and the engine was running at her proper lead.

Q. Suppose the upper diagram on that paper represents a blast cylinder card, what does it show?

A. I call it a very pretty card, indeed—an exceptionally good one. The rising pressure is straight, showing that the moment the stroke commenced the full pressure was attained in the blast cylinder and carried regularly almost to the end of the stroke, giving a very even pressure during the whole stroke.

Q. Do you see any indications of leaking or want of seating in these cards?

A. No, sir.

Q. If there was any leaking or want of seating in the valves would the card indicate it?

A. It would indicate if there was any by a fall in the line.

Cross-examination.

By Mr. Tompkins:

Q. What did you say your profession was?

127 A. I call myself a mechanical engineer.

Q. How long have you been calling yourself a mechanical engineer?

A. I can't give the exact length of time; for about 10 or 12 years.

Q. Where did you learn your profession?

A. In the practice of handling engines and boilers.

Q. Where?

A. All over the country.

Q. Did you ever go to a polytechnic school?
A. I never did.
Q. Was your information and knowledge gained from practical experience?
A. Yes, sir.
Q. Did you ever engage in building a furnace?
A. No, sir.
Q. Did you ever engage in working a furnace?
A. Yes.
Q. In what capacity?
A. I have been helper, keeper, hot-blast tender, time-keeper, and engineer.
Q. How long have you been in the employ of Babcock & Wilcox?
A. Twelve years.
Q. Then you were connected with furnaces as labor-, etc., before you went into their employment?
A. Yes, sir.
Q. What position did you occupy when you first went into their employment?
A. I went there as a mechanical engineer, setting up boilers for the different parties to whom they sold them.
Q. Did you set up these boilers for these furnaces at Sheffield?
A. I did not.
Q. When were you in Sheffield?
A. About the 1st of November.
Q. How long did you stay there?
A. About 24 hours.
Q. How did you happen to be there?
A. I was visiting the plants through the country in which these boilers had been put in.
Q. How did you happen to go there; who ordered you to go to Sheffield?
A. I was under instructions.
Q. For what purpose?
A. In inspecting the boilers.
Q. They sent you around to examine the different boilers?
128 A. They did.
Q. Was that without reference to any complaint?
A. Yes.
Q. Have you ever been to Sheffield since November, 1888?
A. I have not.
Q. Have you been elsewhere around the country in the neighborhood to look at boilers?
A. I have not, in the neighborhood.
Q. Have you been anywhere in the South since then to look at boilers?
A. I think not, since then—not farther south than Washington.
Q. Did you see Mr. Chamberlain there at the time you visited these furnaces?
A. I did not.
Q. Whom did you see in charge of the furnaces?

—. I do not remember the gentleman's name.

Q. Did you talk to him?

A. I mentioned the fact about the guage glasses being broken, and called his attention to it.

Q. You do not know who it was?

A. I do not know his name.

Q. Did you look over the furnaces carefully, all parts of them other than the boilers?

A. I did not.

Q. You went there simply to examine the boilers?

A. Chiefly to examine the boilers.

Q. How long were you at the furnaces?

A. Several hours. I got there about noon and remained at the furnaces until night the first day and the better part of the next day, until two o'clock.

Q. How were the furnaces working at that time?

A. Apparently they were not working very well.

Q. You say that was in the early part of November?

A. Yes, sir.

Q. Could you ascertain the reason why they were not working well?

A. No, sir.

Q. Did you try to find out?

A. I did not.

Q. Before you went into the employ of Babcock & Wilcox, 12 years ago, where were the furnaces situated that you worked at?

129 A. The Big Muddy iron w'k's furnace, Jackson, Ill.; the Midland Furnace Co., Crawford county, Missouri.

Q. How long did you work at these furnaces?

A. I think I was 18 or 20 months at the Big Muddy and about six or eight months at the Midland.

Q. Did either of these furnaces use these Babcock & Wilcox boilers?

A. No, sir.

Q. How many furnaces have you ever seen with these glass guages on the boilers?

A. I never counted them; very few that did not.

Q. Do you mean very few that have the Babcock & Wilcox boilers or any kind of boilers?

A. All Babcock & Wilcox boilers are supplied with glass guages.

Q. Are not all other boilers supplied with them?

A. No.

Q. Isn't it very common to have boilers at furnaces not supplied with them?

A. I should not say it was common.

Q. Did they have them at these furnaces at which you worked?

A. Yes, sir.

Q. Do not boilers always have test cocks, by which you can find out the quantity of water in the boilers without looking at the glass guages?

A. Boilers have test cocks, by which you can tell whether the water

is above or below a certain point, but they do not indicate where the water is in every case.

Q. Do these glass *guages* indicate where the water is?

A. If they are in proper condition they do.

Q. Do you mean that they will tell exactly where the water is in the boiler?

A. If they are connected and in proper condition they will.

Q. Do not they frequently get out of condition and out of order?

A. They are easily kept in condition, and if they get out of order it is because they are not taken care of.

Q. Are they not apt to get stopped up where dirty and muddy water is used in the boilers?

A. They are.

130 Q. Then is it safe in the operation of boilers where muddy water is used to rely entirely upon these glass *guages*?

A. It is, if you will keep them in proper condition.

Q. Is it not safer to rely on these test cocks to show where the water is?

A. No, sir; not exclusively.

Q. When you saw these boilers were they properly set and did they have all the appliances that was necessary and proper for them?

A. The appliances were all sent with them. I did not look up all the tools and apparatus that were sent with them. They were properly set up, and, as far as I know, had all appliances.

Q. Were they arranged for a proper burning of the gases at the time you saw them?

A. What do you mean by that?

Q. The boilers; that's what we are talking about.

A. As far as I know they were arranged for a proper burning.

Q. Do you know whether there were any flame plates set up under these boilers at the time you saw them?

A. I think there were not in all at the time I saw them; there were in some of them.

Q. Then these boilers, in which the flame plates were set up, were set up properly?

A. The boilers were the same in each case.

Q. Which was best, the way some were fixed with flame plates or the way others were fixed without flame plates?

—. I think the ones with flame plates are better arranged.

Q. What difference does it make whether or not flame plates are set up?

A. The gases would have longer travel through the heating surface than they would without them.

Q. You said that it was easier to clean the tubes in the Babcock & Wilcox boilers than in any other boilers, did you not?

A. I did.

Q. Do you mean by that that it is easier to clean the tubes both inside and out than in any other kind of boilers?

A. I do.

Q. How long would it take to clean the tubes of one of these boil-

ers at these furnaces, inside and out, and put the boilers in good condition?

131 A. Cleaning the tubes inside would depend upon the amount of scale and muddy matter in them, and also upon the quality of that scale, whether it stuck to the tube or came off easily; the outside would only take a few minutes.

Q. What occasions that hard matter on the inside of the boilers?

A. Foreign matter in the water.

Q. Does mud do it?

A. Yes, sir.

Q. To what extent does mud cause scales in the boiler compared with lime water?

A. I cannot give a definite answer. The amount of scale depends upon the percentage of foreign matter in the water; sometimes it is very great and sometimes very small.

Q. What is the average time it takes to clean a battery of these kind of boilers used in the South, inside and out?

A. I have never had the time it required from any reliable source.

Q. Then you don't know?

A. Not in the South.

Q. What is the average time it takes to clean a battery of the kind of boilers that are at these furnaces in the North?

A. The water varies in different localities. Some boilers do not require any cleaning hardly; you can wash them out in an hour with the hose, while others require a day or two of scraping.

Q. Could you take all the caps from the tubes and clean out the tubes and put the caps back in an hour?

A. No, sir.

Q. If you take a Babcock & Wilcox boiler of a given power, say the same as these at Sheffield, and then take a boiler of the same power with two flues, which is the more easily cleaned of the two with the same kind of water and running the same way?

A. If the two-flue boiler was large enough, it probably could be as easily cleaned on the inside as the Babcock & Wilcox. I don't suppose all the surface of the flues could be reached, though.

Q. Are there any steam drums on these Babcock & Wilcox boilers?

A. The top drum, called the steam and water drum, has both steam and water in it.

132 Q. Has that steam drum the capacity that boilers of that size usually have to hold steam?

A. Boilers are very different. It has more than some and less than some.

Q. Did you ever see any boilers at any blast furnace with any less capacity in the drum for holding steam than do these boilers at Sheffield furnaces?

A. I have never measured any boilers outside of our own at blast furnaces and am not able to compare them closely.

Q. Suppose there was a steam drum at each battery of boilers 30 in. in diameter, 10 ft. long, and 18 in. above the top of the boiler,

would there be a likelihood for the water to go to the engines as readily as from these boilers at Sheffield?

A. With a proper party handling the boilers there would be no likelihood in any case.

Q. Would it require more skill and care to prevent water going from the Babcock & Wilcox boilers to the engine than in the boilers that I have just described?

A. No, sir.

Q. Have you ever had any experience in any other kind of boilers than these?

A. I have.

Q. What experience did you have?

A. I have had charge of other boilers.

Q. When?

A. As far back as when I was 16 years old. I had charge of the boilers on a sugar plantation.

Q. Did you have charge of the boilers at a furnace?

A. Yes, sir.

Q. In what capacity did you have charge of them?

A. As engineer.

Q. When you see a large amount of water coming out of the exhaust along with the steam, is it any indication that water is escaping from the boilers to the engine?

A. No, sir; not necessarily.

Q. Is it generally the case?

A. I think not.

Q. Suppose there is no leak in the heaters and yet there was a large amount of water coming out of the exhaust with the
133 steam, would not that indicate that the water was coming from the boilers to the engines?

A. It would not without some other indications. It would indicate that the heater was absorbing a large portion of the heat in the exhaust steam, condensing it to water.

Q. Suppose there was an inch hole at the bottom of the heater to let the condensed water out, and yet there was a large quantity of water escaping through the exhaust with the steam, would not that indicate that there was water coming from the boiler to the engines?

A. Not necessarily.

Q. How, then, can you tell whether or not water is coming from the boiler to the engines?

A. The first indication of water in considerable quantities would be a thumping in the cylinder of the piston striking against the water.

Q. Suppose there is no thumping and still a large amount of water coming out of the exhaust pipe?

A. I should not believe that there was much water being carried over to the engine.

Q. Then how would you find out and thoroughly test it to know whether or not water was coming from the boilers into the engine?

A. I should test my steam from the top of the boilers, where it is first drawn from the boiler.

Q. Suppose that was all right, then what?

A. Then I would know it was all right; there is nowhere further to look.

Q. Didn't you say something about an appliance that you could attach so as to tell how much water was escaping from the boilers to the engine?

A. I said that there was such an apparatus for testing the quality of steam; it also could be determined by means of an indicator, and by weighing the water condensed.

Q. How many furnaces that you know of have these appliances attached?

A. I know of only two; they have them at the Byrd-Coleman and at the Big Muddy.

Q. Were they in constant use there for the purpose of mak-
134 ing these tests?

A. I don't know.

Q. How many furnaces do you know of that have these appliances which they constantly use for the purposes of testing whether or not the engines are working right?

A. I don't know how many of them do it.

Q. Do you know of any?

A. I have not been at any since I left; that's the only chance I had of knowing of any.

Q. You just know that such things exist, but you do not know how frequently they are applied?

A. No, sir; I don't know how frequently they are applied.

Q. Suppose you were running all the boilers at that plant and all of the engines in running the three furnaces, would not the percentage of waste in power an- condensation be just as great as if you were running only one furnace with the necessary boiler and engine power to run it?

A. I think there would be a smaller percentage of waste if you were running three furnaces, with sufficient boilers and engines to run them, than there would be if you were running one furnace with the boilers and engines sufficient to run that.

Q. Can you give a reason for that?

A. I tried to give one in my examination.

Q. Did you examine with much care and particularity when you were at the furnaces in November last the eye beams that hold up the boilers?

A. I have no recollection of giving them any special examination.

Q. Then you did not observe that they had settled over two or three inches in the middle?

A. I did not notice that.

Q. Suppose there is 100 ft. of 12-in. pipe over the boilers and about 120 ft. over the engines, and that these two pipes connect by three 12-in. pipes forty to fifty ft. long without any valves in any of the steam pipes, would it not be safer and more convenient to have

pumps of all kinds connected directly to each of these boilers so that in case any of these joint-, or half a dozen of them, should
135 get out of order you could still run your pumps without shutting off the steam of the main pipes or any portion of them?

A. I do not see the necessity for having it so arranged.

Q. Suppose, then, four or five of these joints should get out of use, would not it be convenient and more safe if you could use your pumps directly from the boilers rather than to stop until you could make these joints?

A. That would depend largely upon what your pumps were running for.

Q. Suppose the pumps were running to supply all the furnaces and the hot blast with the water for the coolers, tuyeres, and valves, and also keep water in the boilers?

A. I must say that I do not see the necessity for having them connected differently.

Q. Then you don't see that it would be any advantage to have that connection so that you could prevent losing water to your furnace or valves or at other places, when the tanks themselves would not last for all the furnace- more than two hours?

A. It is a case that I would want to be familiar with the size of the pumps and tanks, etc.

Q. Supposing in the pumps in the engine room there were four valves, and in the pipes in the boilers there were four valves, so that in case any of the joints in one of the cross-pipes from the engines to the boilers should give out or should break from any cause or defects in the pipe, would it not be a great convenience to have these valves there so that you could shut off these pipes without any loss in running?

A. I do not consider it a convenience nor an element of safety, for this reason: By putting in so many valves you double your number of joints and double the chances of leakages occurring from them. If you are assuming that your pipes are put up in such a manner that leaks will occur by inserting so many valves, you will double the number of joints, and thereby double the liability of these leaks occurring.

Q. Then you would consider it no factor of safety or convenience not to be obliged to stop from half an hour to two or three hour- to repair joints, stopping your whole furnace?

136 A. I should not stop my whole furnace to repair joints. I should put up my joints properly in the first place and test them.

Q. What would you think, then, if in the steam pipes from the boilers to the engine every joint got to leaking badly inside of six weeks to two months, from the time the furnace was blown in?

A. I should think there had been a blunder or mistake made by some one.

Q. Suppose that where one of the flange joints was in this steam pipe there should a leak occur where the flange was screwed onto

the pipe, how long would it take to repair that leak, if you had to take off the flange?

A. I would not venture an opinion on that without seeing it.

Q. State why it was, if you knew, that you happened to be sent to Sheffield to inspect these boilers.

A. My instructions were to go South and inspect all plants that I could see conveniently.

Q. Where else did you go on that trip except to Sheffield?

A. South Pittsburgh, West Nashville, Birmingham, Wheeling, Bessemer, Gadsden, Macon, Atlanta, Cedartown, Chattanooga.

Q. Did you take written memoranda as to the condition in which you found the boilers at the different points you went?

A. I did.

Q. Did you take it as to the Sheffield boilers?

A. I did.

Q. Do you know why it was that they sent you around? Did they owe any duty to the parties to whom they sold the boilers to make this inspection?

A. No, sir; it has always been our custom to visit all our boilers after they are constructed as frequently as it is convenient.

Q. For what purpose was it?

A. For the purpose of knowing what satisfaction our boilers were giving, what condition they were in, how they were taken care of, and how they were liked.

Q. Was there any agreement to this effect?

A. No, sir.

Q. They always had a fatherly curiosity of knowing how their children were coming along after they send them off?

A. We never lose sight of a boiler after it is sold.

Q. What condition did you find those boilers in at South
137 Pittsburgh?

A. They were in good condition and I so reported.

Q. Do you know anything about a man being sent by the firm of Babcock & Wilcox, soon after you were there, to look after the boilers at Sheffield?

A. I do not recollect of any such man at such time.

Q. If such a man had been sent would you have known it?

A. I might and might not.

Q. Do you know how to calculate the horse power of an engine?

A. Yes, sir.

Q. Suppose, then, you have an engine of 36 in. diameter cylinder and four-foot stroke, running 40 revolutions per minute, with 80 lbs. steam pressure throughout the stroke, what would be the horse power?

A. 789.7.

Q. Would it make any difference in the horse power if the engine was running 30 revolutions instead of 40?

A. It would.

Q. Could you readily give the difference?

A. It would be one-fourth less.

Q. What could break the bed plate of an engine set up and running?

A. I do not know. There are a great many different types of engines. I can't answer the question in that shape.

Q. What would break the bed plate of an engine set up and running?

A. If the engine was properly proportioned and the bed plate strong enough, nothing but an accident in running could break it.

Q. Now, what kind of an accident?

A. I don't know as I could describe one.

Q. Can't you conceive of any irregular working of the engine, from any cause, that would result in breaking the bed plate?

A. I can't say that I do now. I have no diagram before me to guide me.

Q. Suppose you had one, would that aid you?

A. I do not — as it would.

Q. You could not determine what broke that bed plate?

A. I could not describe any accident that would break it.

Q. Would the fact that too much water got in the cylinder cause *the* it to break?

A. I am not able to answer that. I should want to make a careful examination of the engine.

Q. Then, in an irregular action of the engine that could cause the breaking of the bed plate, would it or not create sufficient concussion throughout the building for a man there to know that something had happened?

A. If a man was standing there I should think he would be aware of it.

138 Q. Would an engine of over seven hundred horse power, running over 40 revolutions per minute, with 80 lbs. pressure, be sufficiently bolted down if it had bed plates about ten feet or a little over, with *one* four 2-inch holding bolts, one at each corner?

A. I should not want to say what would be sufficient to hold down an engine of 700 horse power, for the data that you gave me is very unusual and would hardly be found in practice.

By Mr. GUNTER:

Q. What data do you say is unusual and not to be found in practice?

A. Carrying 80 lbs. pressure for an engine of that size.

Q. If there was 80 lbs. pressure on an engine throughout the stroke, how much blast pressure would be required to resist it, if there was 84 in. diam. in the blast cylinder?

A. It would be equal to 14.7 lbs. per square inch upon the blast cylinder.

Q. Therefore the blast pressure would in that case be 14.7 pounds.

A. Yes, sir.

Q. If the piston, in descending, came against the block of water when the engine was running rapidly and just before it reached

the end of its stroke, would not the result of that be to lift the shafting?

A. It would pull the shafting upwards.

Q. And then after the shafting got up it would have to come down suddenly?

A. It would come down as soon as the water was released.

Q. Wouldn't it come down with a pound on the bed plate?

A. It would be very likely to.

Q. And if that pounding was continued with 30 lbs. weight, would it not be likely to break something?

A. Yes, sir.

Q. Would it not be likely to break any bed plate?

A. Yes, sir.

Q. Would not that pounding make sufficient noise to attract any man's attention who was near it?

A. Yes, sir.

139 *Deposition of Blakey. Filed in Clerk's Office July* 19, 1890. *A. W. McCullough, Clerk.*

(Copy.)

140 United States Court at Huntsville.

GORDON, STROBEL & LAUREAU
*vs.*
SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY COMPANY *et als.*

On reference before David D. Shelby, special master.

*Deposition of D. A. Blakey.*

Examined by Mr. WM. A. GUNTER:

Q. What is your business—what are you engaged in?

A. I am engaged as ass't instructor in the mechanical department of the college at Auburn, Alabama.

Q. What training have you ever had in the way of mechanical engineering?

A. Well, I took a course under the instructor at the A. & M. College during the term of 1886–'87, and since that I have read a good deal on the subject, and I have had some practical shop work.

Q. Since then you have been engaged in the college?

A. Yes, sir.

Q. Mr. Blakey, did you ever see the engines at Sheffield, Ala., under the control of Mr. Chamberlain, the president?

A. Yes.

Q. Did you make an examination of them?

A. Yes, sir.

Q. Well, now, from your examination of them, Mr. Blakey, state whether or not, in your opinion, they are constructed properly, sufficiently strong, and well proportioned?

A. Yes, sir; I think they are from what I saw of them, and they seemed to be thoroughly made and properly constructed in every way.

Q. Were there any parts of those engines which, in your opinion, were too light?

A. No, sir.

Q. How were the foundations?

A. The foundations generally were solid and good. In
141 one case out of the seven that I saw the foundations seemed to have settled very slightly.

Mr. J. M. WHITE: It is understood that we object to all of this testimony which is not in rebuttal of Mr. Tompkins' testimony.

Mr. GUNTER (resuming ex.):

Q. In reference to the bed plates of those engines, they were, in your opinion, sufficiently strong?

A. Yes, sir.

Q. Looking at those engines, state whether or not, in your opinion, they are competent to run at 45 revolutions per minute with a pressure of 10 pounds upon the blast cylinders.

A. Yes, sir. In making calculations of the number of revolutions that the engine could run I found that it could run even more than that.

Q. If they ran at 45 with a 4-foot stroke, the distance the piston would have to reveal per minute would be 360 feet per minute?

A. Yes, sir.

Q. Is not that rather a moderate speed?

A. Yes, sir; moderate piston speed.

Q. What is called high piston speed? Is it about 600 feet?

A. I am not prepared to answer exactly. The speed of cast iron, the safe speed of cast iron, is 80 feet per second—that is, cast iron; any sort of cast iron, fly-wheels or anything.

Q. Well, 360 piston feet per minute you say is moderate speed?

A. Yes, sir. We say from 450 to 500 would be rather rapid speed.

Q. Suppose the moving parts of those engines, which includes the piston, the connecting rods, the cross-heads, the main shaft, and the fly-wheels, weighs 65,000 pounds, would any pressure in the blast cylinder, which would be less than that weight—would it be any severe duty upon the engine at all?

A. No, sir.

Q. When were you up there at those engines?

A. I was there last Sunday and Monday, the 6th and 7th, I believe.

Q. Did you see them running those engines?

A. Yes, sir.

Q. Did you see them operating the boilers, too?

A. Yes, sir.

142 Q. Did you see any evidence of bad management while you were there in the running of the engines or the operation of the boilers?

A. In the first case, in the boilers in some cases, the water was carried very high; in one case, I noticed especially, it was above the 3rd *guage*; and then, as for the running of the engines, I was in the engine-room at one time when orders were given to stop one engine and put on another, and instead of cutting off with the valves—cutting the steam off—the engineer just unhooked the eccentric from the valve and stopped the engine before it made another revolution, and that, of course, was a very great strain upon it—anything which gives a sudden, heavy lick.

Q. If the engine is running under a head of steam and duty and is suddenly stopped by unhooking the eccentric from the valve, as you saw this done, what effect would it have?

A. The effect it would have on the engine? Of course, it stops the engine exactly at that place, and the velocity the fly-wheel has would make a great strain on the pin and everything connected with the connecting rod and pin, being in a certain position, and the fly-wheel, having such a great velocity, in stopping, of course, would be a great strain on the end of the cylinder, and would have a tendency to burst out the cylinder head, or on the other parts, which goes back on the bed plates.

Q. When it stops that way does it shut the steam in?

A. Yes.

Q. The engine is stopped suddenly?

A. Yes, sir.

Q. If water is carried too high in boilers, what is the result of that?

A. The steam is called what is called wet steam, and, of course, it is not near as elastic as dry steam.

Q. Any danger of water going over with the steam?

A. Yes, sir; when the steam carries the water wet in the form of vapor.

Q. If water is carried over from the boilers and goes through the engine, what effect does that have if it is in large quantities in the cylinders?

A. Well, it does not work the engine nearly so well as good, live steam, and then it would be a strain on the cylinder head on account of the lead which the engine has; of course, this lead
143 is put on to allow certain amount of steam to stay in the end of the cylinder to form a cushion for the piston; now, if water was in there instead of steam, the water, not being as elastic as steam, will not compress, of course, and there is a very great strain on the cylinder head, and that strain, if it does not burst the cylinder head out, is carried onward to the bed plate, or the part which sustains the cylinder.

Q. Do such things as that break a bed plate?

A. If the lead was sufficiently large—sufficiently great.

Q. Did you see the engines at the furnace which was run by Mr. Dowd in Sheffield?

A. Yes, sir.

Q. In your opinion, which is the best engine, those under charge of Mr. Chamberlain or those in Mr. Dowd's furnace?

A. Those under charge of Mr. Chamberlain.

Cross-examination.

By Mr. WHITE:

Q. How old are you, Mr. Blakey?

A. 21 years old.

Q. When did you first read under the instructor at Auburn?

A. In the fall of 1886.

Q. That was when you were 18 years old?

A. Yes, sir.

Q. How long did you read with that instructor?

A. I was there with him until June, 1887.

Q. How many months?

A. From the 5th Oct., 1886, until—I don't remember the exact date—about the middle of June—about 9 months.

Q. Were you taking a regular or irregular course in the study of mechanics?

A. I was taking an irregular course; they have no regular course in that college; they merely have a course of mechanic engineering.

Q. Did you graduate?

A. I graduated with the degree of master of science.

Q. Did that course embrace civil engineering or mechanical engineering?

A. Civil engineering; yes, sir.

Q. In that irregular course what science did you study?

144 A. Well, you mean in the mechanical department? I studied elementary mechanism in the text books and I took a lot of lectures on steam engineering.

Q. When did you work in the shops?

A. About 8 months in the fall, winter, and spring of 1887–'88.

Q. What shops?

A. Janney & Co.

Q. Where is Janney & Co. located at?

A. Montgomery.

Q. What kind of founders are Janney & Co.?

A. General founders.

Q. Does that embrace ropairing, and does it also embrace the building of steam-engines?

A. Yes, sir.

Q. What kind of steam-engines do Janney & Co. build?

A. They build plain horizontal engines.

Q. Stationary engines?

A. Yes, sir.

Q. None heavier than to run saw-mills or gins?

A. No, sir.

Q. Did you ever build a steam-engine to run a blast furnace with?

A. No, sir.

Q. Did you ever work in a shop where one was built?

A. No, sir.

Q. Then your knowledge of engines for blast furnace is derived from the knowledge you got from your study at school and your lectures in connection with the practical work that you did in Janney's shops?

A. Yes, sir.

Q. You never worked at iron furnace, did you?

A. No, sir.

Q. You do not claim to know anything about the practical workings of an iron furnace?

A. No, sir.

Q. You know nothing of iron smelting?

A. I know the process by which iron is made. I know the proportions. I know exactly what to do.

Q. You know the theoretical parts—or principles that you learned from the books?

A. Yes, sir.

Q. You went to Sheffield at the instance of the complainants for the purpose of examining this machinery?

A. Yes, sir.

Q. What examinations of the engines did you make outside of an inspection of them?

145 A. Well, I took the dimensions of the bed plate and the housing.

Q. Then you made only an inspection accompanied by measurements of the different parts; that is all?

A. Yes, sir.

Q. What inspection did you make of Dowd's engines?

A. I merely looked over them.

Q. Were not Dowd's engines of the same horse power as Cole's engines?

A. I do not know that I could tell you exactly. If I had the size of the cylinder I could tell you.

Q. You say you do not know whether they are the same power engine or not?

A. I do not know.

Q. Why do you say the Cole furnace engines are better than the Dowd engines or the engines at the Dowd furnace?

A. In the first place, there is a great deal better arrangements for the working of the valve—the cut-off is arranged a great deal better than the arrangements of Mr. Dowd's. In the Dowd engines they have no arrangements by which you can regulate and cut off speed without stopping the engine and changing the eccentric, but with these at the cole, iron & r'y company's furnace they have an arrangement by which the eccentric can be changed on the main shaft without stopping, and cutting off can be regulated by means of this.

Q. What have those things you mention to do with the capacity of the engine?

A. That had nothing to do with the capacity.

Q. It is nothing but that the conveniences are better arranged?

A. Yes, sir.

Q. Then you cannot say that the engines are inferior or better in point of capacity than the Cole engines?

A. No, sir.

Q. When you stated that you meant that the matter of arrangements was better?

A. Yes, sir.

Q. What do you mean when you say that they — sufficiently strong?

A. I mean that every part is of sufficient size to stand the strain that is demanded of them.

Q. Do you mean that they — sufficient in their parts, in the proportion that one bears to another, or sufficient to do the work
146 required of them?

A. Sufficient to do the work required of them.

Q. What work is required of those engines?

A. What is it you want?

Q. You say you mean in your answer that they — sufficient for the work required of them. I want to know, if you know, what work is required of them.

A. The general requirements for a blast-furnace work is not more than 5 or 6 pounds to the square inch on the blast piston, and this engine can do work as much as 10 pounds to the square inch.

Q. What leads you to the opinion that the engine will work under a blast pressure of 10 pounds?

A. The calculations made on the matter.

Q. You got that from your measurements of the different parts?

A. Yes, sir.

Q. Could that engine run seventy revolutions with ten pounds of pressure?

A. No, sir.

Q. Could it run 50?

A. I do not know that I could say positively if it could or not?

Q. Could it run 45 revolutions with 10 pounds pressure?

A. Yes.

Q. What amount of resistance is there in 10 pounds pressure in a blast cylinder to that engine?

A. 55,410 pounds.

Q. What do the moving parts of the engine weigh?

A. 65,000 was what was told me was the moving parts of the engine.

Q. How many revolutions would that engine run in regular work under 10 lbs. blast pressure?

A. That would take some calculations for me to tell you exactly.

Q. About how much?

A. Between 45 and 50.

Q. Would it work ten pounds pressure of 60 revolutions steady work?

A. I do not think it would; I cannot say positively without making calculations.

Q. Does an increase of the revolutions under which an engine is run under a given pressure make the burden any greater on the engine?

147 A. Yes, sir.

Q. What proportion is it increased?

A. I do not know exactly. The power of the engine is calculated by means of the area of the piston multiplied by the main pressure by twice the stroke and the number of revolutions. You see there the number of revolutions must come in.

Q. What proportion of increase is there?

A. I cannot say.

Q. You think that while it would stand a regular service of 45 or 50 revolutions that it would not probably stand regular service of 60 revolutions with the same blast pressure?

A. I cannot say that positively.

Q. What is your opinion? You stated you did not think it would. What do you think about it?

A. Of course I still hold to my opinion that I do not think it would.

Q. Then would it run at 60 revolutions under speedy work with 8 pounds pressure—do you think it would stand 60 lbs.?

A. I do not know.

Q. You say that your opinion of the sufficiency of those engines to do the work required of them is founded upon your knowledge of engines and the amount of blast pressure in iron furnaces. Now, what amount of pressure is required in blast furnaces under the varying conditions of a furnace?

A. An average?

Q. No, sir. An engine is put at a furnace to run the furnace?

A. Yes, sir.

Q. The furnace is subject to all the vicissitudes of iron smelting?

A. Yes, sir.

Q. Sometimes in one condition favorable and sometimes very unfavorable. Take the furnace engine required to do all that work, what amount of capacity as to pressure is required to do that work?

A. I do not know that that can be answered exactly.

Q. Does it ever get down as low as three pounds—3 lbs. blast pressure? Could you run a furnace with that?

A. As I say, I do not know anything about blast furnace—that is, the special blast part of it.

148 Q. Then how can you answer the question as to the sufficiency of those engines if you do not know the requirements of the varying conditions of the furnace?

A. It is just as I say; there is varying conditions of the furnace. In some cases it runs well with a pressure of 4 to 6 lbs. to the square inch and works the furnace all right.

Q. You know the engine is capable of doing that?

A. Yes, sir; in very unfavorable conditions where the furnace is choked up. In some cases it may take as much as ten pounds.

Q. Won't it take more in some cases?

A. If the furnace gets choked up entirely it will take more, but 10 lbs. pressure is about the most unfavorable condition a furnace ever gets into.

Q. You do not know of any condition a furnace will get into where it will require more than 10 pounds pressure and still be kept in operation?

A. No, sir.

Q. Don't you know they go as high as 12 lbs. blast pressure?

A. I do not know that I ever heard or read of such a case.

Q. Your knowledge is entirely theoretical on that subject?

A. Yes, sir.

Q. If the condition of the furnace got where it required 10 lbs. pressure you think these engines are able to keep up to that?

A. Yes, sir.

Q. How many revolutions would that engine have to go to make 10 lbs. blast pressure?

A. The pressure of the blast piston is not calculated from the revolutions at all—on the blast piston; it is from the resistance.

Q. Then why is it necessary to increase or decrease the speed of *of* the engine? Why is it necessary that the engine should ever run faster than 23 revolutions?

A. Of course there is a certain amount of velocity with the piston, that the piston has to travel at to keep up the blast to a certain pressure, and if the blast goes off too freely and there is not much resistance of course the pressure is not so great.

Q. When is that that you have to increase the speed of your engine to keep up the 10 lbs. blast pressure? You say you cannot keep up the blast pressure with the engine running 23 revolutions, steady work?

149 A. No, sir; it depends upon the amount of resistance.

Q. Where?

A. The amount of resistance to the blast.

Q. That the blast meets in going into the furnace?

A. In going to the furnace and between the furnace—the amount of resistance to the entire column of blast.

Q. Did you measure these boilers?

A. No, sir.

Q. Do you know whether two batteries of boilers is sufficient to run two engines there—two batteries making four boilers?

A. I did not measure the boilers.

Q. Then you cannot undertake to answer that question, of course?

A. No, sir; not without knowing the heating surface.

Q. They were running 2-½ batteries of boilers?

A. Yes, sir.

Q. You say you found in your examination of the boilers that the water was too high in one of the boilers?

A. I just noticed this one case especially.

Q. You do not know whether they were carrying the other boilers to the same height or not? Did you examine all — them or one?

A. I did not examine specially all of them, but just happened to see this one and happened to notice another that was not too high.

Q. The water in that boiler was at the three cock—was it above the three cock?

A. I do not know how much it was above.

Q. You could not tell how much above?

A. No, sir; but that it was above, and I spoke to the manager at the time of it and he said that the glass tubes could not be depended upon and wanted to find that it could be depended upon.

Q. Found it could be depended in that instance?

A. Yes, sir.

Q. Was there a glass *guage* to the one you were speaking about?

A. Yes, sir.

Q. They did have glass *guage*- on all of them?

A. Yes, sir.

Q. What is the amount in barrels of water that those boilers
150 will hold between the middle cock and the top cock?

A. I could not state, as I say I do not know the size of the boiler or the measurements at all.

Q. You looked at the boilers to see their construction?

A. The boiler was a water-tub boiler; the water was not in a solid body. I am not able to give the answer.

Q. You say when the water is too high it is likely to go over to the engine with the steam?

A. Yes, sir.

Q. In the shape of vapour?

A. Yes, sir.

Q. When it gets to the engine what does it do—what goes with the vapour?

A. It works through, just like the steam does. It does not do the work that live steam would do.

Q. You say now when it is too high it also goes over in the shape of solid water?

A. No, sir.

Q. Then it cannot go through the engine except in the form of vapour?

A. Unless the water was very high that by the boiling over it would strike the pipe that leads to the engine.

Q. Then there is no danger of water going over to the engine except in form of vapour unless it gets extraordinarily high?

A. No, sir.

Q. How high would it have to get in these boilers?

A. I could not say; it would not have to go so high in the boilers, as there would be no steam. If there is any space left at all in the boiler steam can be made.

Q. You could not undertake to say how long it would take an excess in one of these boilers to be brought to its proper level by the formation of steam?

A. No, sir; it would be rather rapid, though.

Q. From what you say of the construction of these boilers it would necessarily be but a very short while?

A. Not long.

Q. When that vapour gets into the piston you say that it destroys the value of the steam to a certain extent?

A. Yes, sir.

Q. What else does it do?

A. Just as I said. It cannot make a water cushion in the cylinder. If the lead is sufficiently great it can.

151 Q. Did you notice the lead on those engines?

A. No, sir.

Q. You say that stopping the engine suddenly in the manner you testified to having seen that one stopped is calculated to put a strain on the engine?

A. Yes, sir.

Q. That strain would never break the bed plate of an engine unless the other part of the engine receiving the shock first was stronger in proportion than the bed plate, would it? The bed plate is the last place to receive the shock?

A. Yes, sir; the cylinder is the first place to receive the shock, and then of course it would be transferred from the cylinder to the bed.

Q. Go up the shafting, then?

A. It would not go to the shafting at all.

Q. Then it goes to the bed plate from the cylinder head by transmission?

A. Yes, sir; from the cylinder head to the bed plate?

Q. Would it not be a terrible jar and shock that would result in the breaking of a bed plate from a water cushion of that kind?

A. Yes, sir; the jar would be considerable.

Q. Would it not be noticeable by any man with his faculties, standing there by the engine?

A. I should think so.

Q. Who was it you saw unhooking that engine?

A. I could not state whether he was the regular engineer or not. He was the man ordered to stop the engine.

Q. Do you know the man's name?

A. No, sir.

Q. Do you know what engine it was he stopped?

A. No, sir; I could not tell exactly.

Q. There are seven there, and you do not know which one was stopped?

A. No, sir.

Q. What day was that?

A. Monday, the 7th.

Q. About what time of the day?

A. It was about half past 8 or 9 o'clock.

152 Q. In the morning?

A. Yes, sir.

Q. Did it break anything?

A. No, sir; not that I saw.

Q. Is a strain of that kind calculated to weaken an engine or break it?

A. Of course it is a great jar and it is calculated to loosen any part sufficient so as to break it, but it did not do any damage on that occasion.

Q. When that unhooking occurs and nothing is broken are any parts of the engine weakened; is it not as good after that as before?

A. If an engine is stopped that way several times I should say it would cause such a jar that it is bound to weaken some parts.

Q. You mean a repetition would weaken some of the parts?

A. Yes.

Q. How would stopping an engine that way weaken any of its parts, provided it did not break it at the time it happened?

A. It would work the brasses loose, and the connecting rod and joints about the engine where the strain was, of course it would have a tendency to jerk those.

Q. Is it not like suspending the axle wheels on the axle and grabbing one of the spokes and stopping it?

A. That is all.

Q. It is a sudden jar?

A. Yes, sir.

Q. Then the sudden jar is not calculated to weaken any parts of the engine except those that are fastened together?

A. No.

Q. It cannot weaken the bed plate, can it?

A. No, sir; except by cracking it in some way it would weaken it.

Redirect.

By Mr. GUNTER:

Q. When the water gets above the last *guage* in the boiler how can you tell whether it is full or not?

A. You can tell after it gets above the glass *guage*.

Q. After it gets above the last *guage* you have to look out—you cannot tell whether it is full or not?

A. Yes, sir.

Q. It may be running over?

A. Yes, sir.

153 Q. And carrying the water straight into the engine?

A. Yes, sir.

Q. If the water is in the bottom of the cylinder when the engine is running rapidly is not the blow directly upon the bed plate?

A. Yes, sir.

Q. Did you ever build an engine?

A. I never built one by myself, but have assisted.

Q. Does it make any difference what the engine has got to be put at, so far as the construction of its parts are concerned, in the due and proper proportion of it?

A. No, sir.

Q. That is regulated by the dimensions of the cylinder?

A. Yes.

Q. That marks the duty which the engine can do?

A. Yes, sir.

Q. It makes no difference whether it is to run a blast furnace or a saw-mill?

A. Yes, sir.

Q. You said that you saw them running 2-½ batteries. State whether they had an excess of steam or not.

A. The night before I got over there—I got into Sheffield on Satday night—I heard them blowing off steam a good deal, and I did not notice especially after that. I just happened to notice it then.

By Mr. WHITE:

Q. Where did you stay Saturday night?

A. Mr. Dowd's house.

Q. How did you know it was the furnace blowing off steam?

A. I was out looking at the furnace about 8 o'clock.

Q. Did you see it?

A. I was not at the furnace, but at Mr. Dowd's house. I knew it was the furnace, because it had been pointed out in the afternoon.

Q. Is not that the ordinary course at a furnace—that they regulate the steam by blowing it off?

A. Any boiler when it has too much steam blows off.

Q. You do not know whether they were making that steam with 2 batteries or 2-½ batteries?

154 A. No, sir; I just saw from the house it was blowing off.

I, the commissioner in said commission named, do hereby certify that the evidence of the witness, D. A. Blakey, was taken down under oath in my presence on the 12th day of October, 1889, at Montgomery, in the county of Montgomery and State of Alabama; that proof has been made before me of the personal identity of said witness, and that I am not of counsel in the cause or kin to any of the parties in interest or in any manner interested in the result thereof.

Witness my hand and seal.

PATRICK McGAULY, [L. S.]
*Commisioner.*

155 *Deposition of Major E. Dowd. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

(Copy.)

156 Major EDWARD DOWD.

Direct examination by Mr. GUNTER:

Q. Where do you live?

A. At Sheffield, Alabama.

Q. What is your business?

A. I am a manufacturer of pig-iron and superintendent of the Lady Ensley and Hattie Ensley furnaces.

Q. How long have you been engaged in the business of manufacturing iron?

A. Between fifteen and sixteen years.

Q. What acquaintance have you with the nature and capacity of machinery for the manufacture of iron in blast furnaces?

A. I have a very full acquaintance; I have made drawings and built furnaces; have operated them continually for the last fifteen years.

Q. You say that you are now superintendent of the Lady Ensley furnace and the Hattie Ensley furnace?

A. Yes.

Q. What furnace, in your opinion, at this time is doing the best work in the way of manufacturing pig-iron in this State?

A. The Lady Ensley.

Q, Both as to quality and quantity of iron and economy of fuel?

A. Yes.

Q. Are you acquainted with the compaay which made the contract with Gordon, Stroebel and Laureau for the erection of three furnaces at Sheffield?

A. I am.

Q. Before that contract was entered into state whether or not the parties in charge of the making of the contract summoned to their aid experts and submitted to their considerations plans and specifications for the erection of said furnaces.

A. Yes; they did, sir.

Q. Who were those experts?

A. Gen. Williard Warner and myself.

157 Q. How many plans and specifications were offered?

A. Three.

Q. Were they all considered?

A. Yes.

Q. Were there any alterations made in them?

A. Yes; numerous alterations.

Q. By whom?

A. They were requested by executive committee and assented by the parties offering them.

Q. Who composed that committee?

A. Col. Cole and Col. Colvar, who was president, and, I believe, Gen. Warner.

Q. At any rate, Gen. Warner was consulted and gave his advice?

A. Yes.

Q. What is his capacity as an expert in the business of iron-making?

A. He has been a manufacturer of iron and is a large owner of the plant he operates, and very successful, too.

Q. What bid and specifications did you finally determine to accept?

A. I did not have the determining of it; the executive committee did that.

Q. What bid and specifications did you most earnestly recommend to be accepted?

A. That of Gordon, Stroebel and Lareau.

Q. Did Mr. Warner unite in your recommendation?

A. He did.

Q. Did you give these plans and specifications and propositions full and ample considerations in every detail?

A. I did. I spent nearly the whole week in contin-ous work, putting in a good deal of time at night.

Q. In accepting and considering these specifications and propositions, so far as the sufficiency of the plans and specifications were concerned, did you rely in any respect otherwise than on your own judgment?

A. No.

Q. There was no trust given as to the sufficiency of the plans and specifications to the parties making them, were there?

(Mr. White objects.)

A. No.

158 Q. You and Gen'l Warner—did you regard him and yourself as competent to determine upon the sufficiency of the plans and specifications for the erection of the blast furnaces in all their details?

A. I did.

Q. And you did exercise your judgment in that matter?

A. I did.

Q. State, so far as these particular specifications and plans are concerned, whether or not they are more than usually in detail.

A. They are.

Q. State whether or not in plans and specifications if fullness of detail does not place before the mind and enable it to judge with more accuracy as in the actual capacity and sufficiency of the work when completed.

A. It does.

Q. The effect of full detail in specifications is to eliminate as to their fullness all room for difference as to what the thing contracted for is to be?

A. Yes.

Q. The contract and specifications actually entered into—are they not the actual original contract and specifications submitted?

A. Yes.

Q. Was not the original altered?

A. Yes.

Q. After the alterations which you recommended and which were assented to were made were they then drawn up and signed?

A. Yes.

Q. Is that (producing a contract) the original contract and these the specifications that were executed and signed?

A. This is the original as signed.

Q. And they embody the alterations?

A. Yes.

Q. State whether or not the original alterations were not embodied in the print itself.

A. Yes; they were in writing.

Q. State in whose handwriting the alterations are that appear in the original contract.

A. In mine; made before the adoption of the contract.

Q. And the clause at the bottom—in whose handwriting is that?

A. In my handwriting, made by the suggestion of President Colvar.

Q. Is that the original specification after being altered and assented to and rewritten?

159 A. Yes; this is the original; the interlineations are in my handwriting.

Q. The signatures at the bottom—whom *as* that signed by?

A. By myself and the directors of the executive committee at the same time.

Q. Well, now, state whether or not at that time you were employed by the company making the contract with Gordon, Stroebel and Laurau, if you had been employed previously.

A. I was called there by a telegram; no arrangement had been made about any compensation or perman-cy of work. They made me a proposition after this. I was ready to take that work and we made an arrangement as soon as possible; I think in twenty-four hours. I took the position of superintendent. By their proposition my pay was to commence either at the first of the month or at the time that I left home; I don't remember which.

Mr. White:

Q. Whose telegram was it that you went to Nashville on?

A. It was from J. C. Warner; he did not state that I was to come, for he had no connection with the company.

Q. How long did you hold that position?

A. I held it until after I had turned the furnace over to Mr. Chamberlain, on the close of the 20th day of October, 1888. My pay continued till the 1st day of November. I held my position until the last day of October, 1888.

Q. Who selected the site for these furnaces?

A. It was selected by conference between the president, myself, and Gordon.

Q. State whether or not Gordon, Stroebel and Laurau went on to complete and erect the furnace and plant as specified in the contract and those plans and specifications.

A. They did.

Q. That was a plant of three furnaces?

A. Yes.

Q. State whether or not during the process of that work it was inspected from time to time.

A. It was.

Q. How often?

A. About every two weeks.

Q. By whom?

A. By me as superintendent of this company.

Q. On those inspections state whether or not any payments
160 were made to Mr. Gerdon.

A. They were.

Q. To what extent?

A. About ninety per cent. of the contract price every month.

Q. But the inspections were every too weeks or oftener?

A. Almost daily I inspected more or less of the work.

Q. State whether or not in the erection of that work in all its details there was any evidence to be seen that it was not executed in a good and workman-like manner.

A. There was not.

Q. It all that plant was *that* any part that was not sufficient in strength, material, design, and workmanship for the purposes for which it was intended?

A. There was not.

Q. In the inspection of that work and the erection of these fornaces did you bring to bear, in behalf of the parties by whom you were employed in good faith, all the skill and knowledge you had of the business?

A. I did.

Q. In all your experience as a fornace man, state if you have ever seen a plant more complete in all its equipments or finished with better workmanship or material.

A. I have not.

Q. Do you know of any fault whatever in its construction?

A. No.

Q. In its plan?

A. I do oot.

Q. Do you believe that there is any?

A. I do not.

Q. Does it conform to the specifications?

A. In every detail it does.

Q. Well, the work wai finally completed?

A. Yes.

Q. Did you pais upon the work ais usual?

A. Yes.

Q. What wai the result of your laist inspection?

A. I made my laist inspection and supplied the company with the ninety per cent. and they paid it.

Q. Did Gordon, Stroebel and Laurau make any further request for a full acceptance?

A. Yes.

Q. What did you do?

A. I wrote to the president.

Q. Did you get to give that acceptance without a conference?

Q. A. I had a conversation nith Col. Cole a few days before, or maybe a week or two, and told him that they would soon
161 have it completed and would want an acceptance, and he told me that it was right and to give them the acceptance.

Q. But still, after that, did you insist upon having more authority from the company?

A. Yes; when Mr. Gordon came there to blow it in he declined to do *io* without an acceptance before I had writ-en that it was complete and ready for acceptance, and he telegraphed the president and brought me the reply *reply*.

Q. You have seen the telegram and acceptance. Is this the telegram which he brought you?

(Witness identifies the telegram*t* of Cole to Gordon and his own letter of acceptance attached to the deposition of Frank W. Gordon as the telegram exhibited to him by said Gordon upon which he acted and gave the acceptance and the said letter as the accept*t*nce given by him, said letter bearing date August 18th, 1888.)

Q. Was that the date *if* the acceptance?

A. That was the date, whatev*a*r the day is. The date of the letter shows the date of the acceptance.

Q. The furnace was not blown in until afterwards?

A. No; the work had been completed by the 8th and had been passed upon by me as competent and the company notified.

Q. You had some experience with that plant and its machinery after that?

A. Yes.

Q. Did you know some of the engires, machinery, and boilers?

A. Yes.

Q. State whether or not, in your subsequent knowledge and experience with that plant, anything *nals* brought to light whereby you were led to believe that you made any mistake before in regard to it details.

A. No; but I think I would moderate that answer in this respect: In the sett*l*ing of the boilers the question had been discussed as to whether it was better to set them one way or another by Mr. Gordon and myself and the Babcock people, and the evidence seemed to be in favour of sett*l*ing them in a certain way, and I did that with the agreement that if it became necessary to change them
162 *that if it became necessary to change them* that I could do *io*. Then, afterwards, I was induced to think that it would have been better set the other way. I do not know that I made a record of that kind to the company, but they were changed by Mr. Gordon and the Babcock and Wilcox people. I do not know who paid for it. My company did nst during my administration.

Q. As originally set, did they meet your approval?

A. Yes. A*t*er the change was desired and after it was made it was not completed and I am not certain that it was begun until after I left. I don't know the effect.

Q. As originally considered, it was adopted after debate?

A. Y*a*s.

Q. Before you made that acceptance state whether or not you made any tests of the machinery or pumps or anything.

A. Yes.

Q. Did you test the engines?

A. Yes.

Q. After you were installed as superintendent at the Sheffield works were your duties at any time cut or enlarged?

A. No.

Q. After the conclusion of the original company's contract with the defendant company, Gordon, Stroebel and Laurau, was there any change made in your duties then?

A. No.

Q. Did you exercise the same duties so far as the supervision and accuracy of the work being carried on was concerned?

A. Yes.

Q. Did the present defendant corporations make payments upon your inspections and reports?

A. Yes.

Q. And did you do this with the knowledge of the officers of the defendant corporation?

A. Yes.

Q. Including Mr. Tompkins, after January 1st?

A. I do not know. He seldom came there and we seldom communicated.

Q. After January you still went on and made the same inspections and directions that you had been?

A. Yes.

Q. And payments were made as usual?

A. Yes.

Q. And so continued till the final completion?

A. Yes.

163 Q. If an iron-maker knows the constituent parts of his ores and his cokes and limestone, can he not figure, and don't he have to if he does his work well, as to the amount of everything to be used in the making of iron?

A. Yes.

Q. Including the volume of air to be consumed with carbon in the furnaces?

A. Yes; the quantity of air is as important as the quantity of ore.

Q. Is not that relation between the relative amount of the various materials used in the making of iron founded upon tests as to the full nature of all the materials for other materials in developing their full capacity?

A. It is founded upon scientific experiments by tests.

Q. What do you use air for in the blast?

A. To supply oxygen to the carbon.

Q. Can the carbon take up more than the given quantity of oxygen?

A. No.

Q. There is a limit to the useful employment of oxygen by the blast—there is a limit to the amount of air needed or that can be used in a furnace?

A. Yes.

Q. Can you state what that limit is?

A. The combustion resulting from the use of carbon and atmos-

pheric air is only to *carbonate* carbonic oxide and not to carbonic acid. To oxidize that carbon to carbonic oxide requires one and one-third pounds of oxygen to one pound of carbon, or sixty-seven cubic feet of atmospheric air to one pound of carbon.

Q. If that quantity of air and oxygen in the air goes into the furnace will it concern its given relation or given quantity of carbon?

A. Yes.

Q. Then in iron-making can there be any use in having any more oxygen or air affording oxygen than is *thos* necessary for the combostion of the carbon?

Q. I do not think you can push air into a furnace any faster than ever, but it divides up the zone of combustion for economical and fairly good work.

164 Q. There is no more carbon burnt than is in there?

A. No; it don't born any more than i*i* in there, but you lose sight of the very important point of the rapidity of combustion.

Q. Well, the quantity being given, do not the iron-makers know the quantity of air to put to it for the complete combustion?

A. Yes.

Q. If in a furnace an incandescent state of heat is necessary to its operation and you pump into it air, state whether or not it is an absolute fact that every sixty-seven cubic feet of air thus pumped in would burn one pound of carbon?

A. Of carbon oxide it would.

Q. Then if yoo have the quantity of carbon used in a furnace you can tell the largest amount of air which could have possibly have entered the furnace by blast?

A. If you have got the carbon t*ae* greatest amount that would utilize combustion.

Q. Does the combustion of carbon show the measure of air that goes into a furnace in a given time?

A. Yes.

Q. You can always calculate the amosnt of carbon if you have got the amoont of c*a*ke and its analy*t*sis?

A. Yes.

Q. If you have got the coke and its analysis and the consumption of the coke can yos then calculate the absolute amount of air necessary for its foll utilization in combustion in the fsrnace?

A. Yes.

Q. What is the capacity of these furnaces—the general average?

A. One hundred and twenty-five tons per day.

Q. What was the relation between the iron here made and the revolutions of the engines used in making the blasts for that iron? Have you any notes?

A. I have no memoranda of the first few days after blowing in and when coming up to her work. For the la*l*t week, from the 16th to the 22nd of September, inclusive, it is necessary for me to state that the iron *not* was not all weighed; the weight of iron is based *s*n the consumption of the ore; it could only get *s*ut after reduction; *being based* basing the weight of iron by the consumption of ore, Mr.

Gordon's average consumption of *f* blalt for the week was five
165 hundred and four revolutions of one engine per ton of iron made, the blast being supplied at an average pressure of four and one-fourth pounds the per square inch.

Q. State how many revoluteons per ton of iron made are shown by your operations now, if you have any that show.

A. This is the daily report of the operation of the Lady Ensley that shows the combustion of five hundred and twenty revolutions to one engine per ton of iron.

Q. At what pressure?

A. Five and eight-tenths pounds per square inch.

Q. From your experience can you say what would be the necessary revolutions of these engines per ton of iron to be produced in this furnace?

A. With the engine and other things in normal condition, from five hundred to five hundred and five revolution- is sufficient per ton with fairly good coke. This five hundred and twenty revolutions was occasioned by heavy valves and the machinery was set to work to part them.

Q. When an ironman sees much increased revolutions per ton for the production of iron, what does he conclude?

A. He necessarily concludes either that the blast is leaking or that he is overblowing his furnace.

Q. Calculate and state what would be the revolutions per minute of two of these engines to produce the necessary revolutions to bring one of these furnaces up to their productive capacity of one hundred and twenty-five tons per day.

A. Upon the result obtained by Mr. Gordon with furnace 8, twenty-three revolutions per minute per two engines for twenty-three hours out of the twenty-four would make one hundred and twenty-five tons.

Q. At what pressure?

A. The pressure varies.

Q. Those revolutions would pump the volume of air necessary and proper for the production of 125 tons of iron?

A. Yes.

Q. And the pressure would vary according to either the leakages or impediments in the way of blast getting into the furnace?

166 A. The pressure would bend to be lessened by leakages, but a bad condition of the furnace increases pressure.

Q. What would be the pressure, everything being in good ordinary condition with materials used in this country used at that furnace, to furnish with these revolutions that quantity of iron to be produced?

A. It would fluctuate between four and five pounds. A pressure of five and eight*h*-tenth pounds at the Lady Ensly produced one hundred and thirty-nine and one-half tons; it is a small fornace.

Q. Say there are three engines at thirty revolutions each, everything being normal, what would be the production of iron for twenty-three hours?

A. That speed should give two hondred and sixty-six tons in twenty-three hours' natural running.

Q. Is that beyond the capacity of these furnaces?

A. Yes; they could not do it in the time required.

Q. Is there anything unusual for the foll operation of these furnaces to their capacity for running the engines for regular work at forty-five revolutions per minute?

A. No; engines always have much larger capacity than is required for regular work, so that if one engine gets out of order we can use the other until it is repaired.

Q. Everything being normal, state whether or nit one of these engines at forty-five eevolstions per minute would carry on the operations at these furnaces reasonably well while the other engine was being repaired.

A. Yes; it could do it.

Q. In such a case yos would have to increase the revolutions of that engine to forty-five per minute?

A. Yes; and that would not yield quite one hundred and twenty-five tons, but close to it.

Q. That would be the only occaiion in regular work in running the engine at forty-five revolutions per minute?

A. Yes.

Q. With the regular work of the furnace, everything being in fair condition, the revolutions of two engines would not have to exceed what?

A. Twenty-three revolutions each.

167 Q. If it appears that in the operations of these furnaces there is any great excess of revolotionns above this scale of five hundred and five hundred and five of one engine per ton of iron, what does it demonstrate?

A. Either something wrong in the management or equipment. The most fruitful source of loss of blast occurs in the outlet or discharge valves from the blowing cylinder; they are in the engine and can be seen only by opening the engine; the heat is generated by the compression of the air and tends to spring the valves a little; the valves are made of leather; when sufficiently sprung *from* by this heat, which may be seen by compression, so that they are no longer covered, the air then passes by from one end of the blowing cylinder to the other and does not go to the cylinder; in this case the fruitfull source of leakage is the improper care of the valves; the temper-ture of the engine, if the valves are not properly fastened in their places, as frequently happens, tends to work the valves open, then the blast will blow around and out of the ideal furnace instead of into the actual.

Q. State anything further that might be wrong.

A. The management of the furnace.

Q. Are there other places where leaks might be?

A. In the connecting pipes.

Q. Might there not be leaks in the blast stoves?

A. Any of the connectisns might be in a leaky condition; all that would be visible.

Q. Might not there be some leaks in the valves of the stoves which would not be visible?

Q. A. Yes; there might be some leaks.

Q. Is there anything further?

A. The volume of air might be very largely increased by reason of necessary amount of fuel; this for five hundred to five hundred and five revolutions is predicated upon a econ-mical use of carbon; if they put in fifty per cent. more carbon than would necessitate fifty per cent. more blast, which would reduce the output of the furnace in proportion. Now, the maker might blow largely more air than ought to be blown, because he did not know how much was required, and would think that the more he blew the more iron he could get.

168 —. The output of iron and the most economical use of carbon in its production, according to your theory, prescribes revolutions not far varying from five hundred to five hundred and five of engines like these per ton of iron?

A. With ecsnomical cumbostion; yes.

A. And anything beyond that is out of the regular work of the engine?

A. Yes; there is another thing that makes an increased quantity of air necessary to a furnace; that is a scaffolded condition; that is an increased volume of air, not for the purpose of making iron, but temperatures for the purpose of regulating the furnace.

Q. What you have stated in reference to the relative consumption of air and the uie of fuel and the output of iron is the result of your experieence, is it not?

A. Yes.

Q. Is it the received opinion among scientific men on the subject of iron-making?

A. It is; except Lothian Bell, who puts the consumption at a little less; he stands at the head as a scientific man and a successfull iron-maker.

Q. Looking at your experience as an ironman and the necessities of blast for regular and irregulae work and looking at your experience with machinery, state whether or not, in your opinion, these engines are sufficient in every respect to do regular work for these furnaces at their foll capacity at forty-five revolutions per minute.

A. They are.

Q. But yo- say that their regolar work for theie furnaces woold not exceed twenty-three revolutions per minute fsr the productions of one hundred aod twenty-five tons for twenty-three hours?

A. Yes.

Q. Are these figures based not only upon your experience elsewhere, but your experience of the *cie* of the matereals in these identical f-rnaces at Sheffield and tests made by you?

A. Yes.

Q. Have you ever had any experience to the contrary?

A. I have not.

Q. The necessities of cumbustion in a furnace requires a certain volume of air?

A. Yes.

Q. And that volume of air, everything being in order and right, is measured by the revolution of the engines?

A. Yes.

169 —. If you get the revolutions per minute, then you calculate exactly what volume of air goes into your furnace?

A. Yes.

Q. In the ordinary conditions, the volumes being determined, the pressure necessary to get that volume is what?

A. The resistance the stock offers—four or five pounds per square inch in a normal condition.

Q. But if there is any obstacle from scaffolding or at the mouth of the tweers which makes the progress of the air through the materials difficult the pressure has to be increased?

A. Yes.

Q. Then any pressure in this country beyond four and a half or five pounds per square inch shows an abnormal condition of the furnace in some way?

A. No, sir.

Q. Explain why.

A. These answers are predicated upon the materials used in the furnace, not upon the materials used in other parts of the country; there is the greatest difference in the world in the materials used in Alabama.

Q. Did you not just now state that four and a half pounds to five pounds was the pressure for regular work?

A. Yes; intending it to apply to these furnaces.

Q. Then if it is above that does it not indicate some abnormal condition?

A. Yes; in these furnaces.

Q. Then ten or nine pounds of pressure is never regular work?

A. No; not normal, healthy work.

Q. It is an indication that the air is wasted or that something is wrong?

A. Yes.

Q. To drive three of these engines at thirty revolutions or two at forty-five per minute requires what quantity of steam greater than the revolutions for regular work, using the same pressure of blast?

A. In proportion to the revolutions; if you increase the pressure you increase the steam; if you double the revolutions with the same pressure you double the steam.

Q. If you double the pressure and the revolutions you quadruple the consumption of steam?

A. Yes.

170 Q. And it requires four times the amount of steam at double the amount of pressure and double the revolutions?

A. Yes.

Q. In the running of furnaces how many valves are there in blast engines?

A. They vary considerably; there are several hundred to an engine.

Q. State whether or not in all blast engines they would have to be constantly watched and repaired.

A. Yes; at the Lady Ensley I buy two hundred and fifty at a time for two engines.

Q. How do these engines compare in make, strength, and general make-up with the engines at the Lady Ensley?

A. They are the same size and, I think, a little heavier in some parts; these engines are much stronger than those at the Lady Ensley; those at the Lady Ensley would not stand the service these have stood.

Q. Are these engines properly proportioned, in your opinion?

A. Yes; very nicely proportioned; the parts requiring strength are made strong.

Q. Suppose the moving parts of an engine weigh thirty or thirty-two tons, is there any danger in running such an engine at a velocity of forty-five revolutions per minute if there is no lifting allowed on the engine to raise the moving parts of the engine?

A. No.

Q. In such a case if the fly-wheel did not fly to pieces would the caps or the top of the main shaft move at all?

A. No.

Q. State whether or not ten pounds of pressure upon these engines would amount to as much in lifting force as the weight of the moving parts, taking them to be thirty or thirty-two tons.

A. No; it would not.

Q. The work the engine would have to do, then, at running at forty-five revolutions per minute under a pressure of ten pounds would not be sufficient if there was no lead upon it or anything beyond the pressure to lift the moving parts?

A. A pressure of ten pounds per square inch upon the side of the piston of the blowing cylinder would not be sufficient to lift the shaft of the fly-wheel.

171 Q. Did you ever see those engines running beyond ten pounds?

A. Yes; at eleven pounds.

Q. Would not the running of those engines at eleven pounds pressure at any ordinary speed test the strength of the engines as much as or greater than ten pounds pressure with forty-five revolutions?

A. Yes.

Q. What speed at eleven pounds pressure do you think would test the strength of the engine beyond ten pounds pressure at forty-five revolutions?

A. Any speed that gives you the pressure would do it.

Q. About what speed did you see it running with eleven pounds pressure?

A. About twenty-seven revolutions.

Q. Would twenty-seven revolutions and eleven pounds pressure

be a greater strain upon the engines than forty-five r-volutions and ten pounds?

A. Yes.

Q. You have had considerable experience with engines and their management and with boilers, have you not?

A. Yes.

Q. If the water is kept in the boilers at the proper level and particularly if water is kept in the Babcock boilers, would any water go out with the steam to the engine except what might be condensed from the steam?

A. Not to any sensible extent; only the water nearly to steam.

Q. Suppose that the water in the boiler is kept excessively high, would it not then likely go over in considerable quantities to the engine?

A. Yes.

Q. Or if an engine is kept standing for some time and there is a long system of steam pipes or mains connected with it state whether or not there would be constant condensation of steam during these stoppages.

A. Yes.

Q. And when the engines are started off, would it not force the water into the engines?

A. No.

Q. Where else could it go?

A. Out of the drip pipes, but a large share would be carried with the steam into the engines.

172 Q. Supposing that the water if carried into an engine with the steam from the water being too high in the boilers or condensing in the steam mains and the engine is started off suddenly at a rapid rate, what would be the effect of the water in the cylinder upon the moving parts of the engine?

A. It would subject them to a very severe shock and strain and would be likely to break them.

Q. Where would this shock be felt—what part of the engine?

A. First in the end of the cylinder and the cylinder head, through the piston to the cross-head, and then to the fly-wheels, and in arresting the motion (momentum) of the fly-wheels. If the fly-wheel is travelling at thirty revolutions, the middle of the fly-wheel is travelling a fifteen hundred feet a minute. The fly-wheels weigh ten tons each. They are made that heavy to give a steady motion to the engine as it passes the center. This sudden arrest of the motion of that middle of the fly-wheel would be very dangerous to the stability of the engine.

Q. In imparting that motion to the fly-wheel it would tend to raise the main shaft?

A. Yes; it would necessarily raise the shaft unless something broke or the water got out of the way.

Q. Would that shock have any effect upon the bed plate?

A. If the caps were in there proper position and the caps below did not break, the bed plate would necessarily shrink up.

Q. Did you ever see any bed plates strong enough to withstand

shocks which might be put upon the- by improper handling of the engine from arresting them too suddenly?

A. I don't know about that; how much they are badly handled. I have never seen a bed plate that I did not think could be broken.

Q. Are the bed plate- of these engines strong enough to withstand any proper use of the engines?

A. Yes.

Q. Did you ever hear anything about those engines when they are running indicating that they are improperly managed?

A. I have.

Q. What did you hear or see, when, and how often?

173 A. When I was running the furnaces at one time I went to the engine-house and found the shaft lifting, and the engine immediately shut down, and the mechanics changed the lead, and it immediately cured the difficulty and started the engine. At another time, after I left there, I heard a pounding of the engine as I passed by and went in to see what occasioned it and found the shaft lifting at every revolution. There was no engineer about that I could see. I stood there only a few moments.

Q. Do you not know the cause of that?

A. Improper lead, the same as before.

Q. In blast engine- there is a cushion in the operation of the engine itself?

A. Yes, upon the air cylinder also there is a cushion.

Q. If you have consideeable pressure in the engine, doei it require much lead?

A. Very little.

Q. If you put too much lead what is the effect?

A. A very severe strain upon the engines.

Q. Is not that the same strain as coming down upon a water hammer?

A. No; the water hammer is elastic.

Q. It is less dangerous than the water hammer?

A. Yes.

Q. Do you know the piston head in the blast cylinder in these engines?

A. Yes.

Q. What is its size?

A. It is seven feet in diameter and weighs two tons.

Q. How is the piston put on?

A. The piston rod is tapered sufficiently and the piston is put on the rod and a large nut put on it and screwed down tight. That is the usual and accustomed method of doing it if it is necessary to make it very tight.

Q. Suppose that engine is running very rapidly and it is suddenly arrested, what is the effect of those arrests upon the piston heads?

A. It drives the rod tighter and tighter on this piston joint, and it may break the piston.

Q. If you had known that these engines had been sub-

174 jected to these strains from water hammers and from improper

lead and should find one of theie piston heads in the blast cylinder broken, what as a scientific man would you say was the cause of the breakage?

A. The repeated shocks caused by the water hammer. The piston might break without being driven down; the water hammer might crack it.

Q. Were the boilers in this case put in of the kind and dimensions and after the manner specified in these speciffications?

A. Yes.

Q. Before you entered into this contract were you acquainted with the character of the boilers?

A. I was.

Q. State whether or not in your opinion these boilers afford the usual heating surface required for running engines of these dimensions.

A. Yes; they are a little larger than usual. Theee is a little higher horse power than -ual; thau the other bidders proposed.

Q. When you have the heating surface of the boilers, and it is an approved plan, is it not a matter of easy calculation to any machinist to determined the capacity for heat and steam?

A. Yes.

Q. Did you make the calculation?

—. I did.

Q. What does the gass depend upon that comes out of the furnace; quantity and quality?

A. It depends upon the cumbustion of the materials and the atmosphere.

Q. There was nothing in the construction of this plant that operated upon the quantity and quality of the gas?

A. No; the production of gas was in the control of the manager.

Q. What is the proportion of carbonic oxide and carbonic acid coming from furnaces well managed?

A. Perhaps the limit of what might be termed the maximum good work would give carbonic acid fourteen per cent., carbonic oxide twenty-eight per cent., and the balance hydrogen.

Q. The only gas which is -seful for burning purposes out of these three coming out of the furnace would be the carbonic oxide?

A. Yes; the others antagonize combustion.

Q. State whether or not in your opinion the largest amount
175 of gases which come from a furnace using brown hematite ore would be sufficient to more than furnish steam and heat at five hundred and to five hundred and five revolutions of the engine per ton of iron at a pressure of five pounds.

A. No, sir; it would not be sufficient.

Q. Why?

A. Brown hematite ore usually contains about twelve per cent. of chemically combined water, and this ore coming fresh from the water containing two or three per cent. of mechanically mixed water, and this water is expelled from the ore in the form of vapor raised into steam, subjected to a very high temperature and excessively beyond steam at atmospheric pressure. At atmospheric pressure

this amount of water contained in steam would yeild, with a furnace going at the speed indicated, 1,727 cubic feet of steam per minute. That steam dilutes the gas, seperating the molecules of carbonic oxygen from one another and very essentially interfering with the proper combustion. In addition to that the enormous volume of steam becomes a vehicle for the carrying away of a very large number of calories of heat, which of itself has a cooling effect upon the mass of gas and deprives the boilers of that much heat, or the stoves, as the case may be, and when the present quantity of gas is insufficient the gas will not burn in a continuous flame, but burns in the form of what we call "goose feathers," one little flake of flame and another, yeilding exceedingly low temperature. This is aggravated by the pressure of lime in the furnace, excessive lime, that yeilds a large amount of floc-ulent ash or matter following with the gas. When the two are combined, very little combustion results, however properly the air may be mixed with the gas in correct proportions. In the use of brown hematite ore it therefore follows that if we would make our steam with the same gas we must necessarily burden the furnace *the furnace* theoretically correctly and handle the gas correctly as to the proper mixture of atmospheric air and in proportion, and further it becomes necessary to always keep the combustion chambers hot, as the gases will only burn after being made hot.

176 Q. Are the ores used in theie furnaces at Sheffield brown hematite?

A. Yes.

Q. At your furnace would the gases which you get from its operation furnish steam and heat for the blast at a revolution of ninety per minute per ton of iron?

A. No; we have to always *to* cool our boilers if we carry a pressure beyond five pounds and *or* press come in irregularly, as they do sometimes, we are to correct the burden. One of the first indications that we get that such is the case is the failure of the combustion of the gases, which we promptly correct by regulating the burden and restoring the combustion of the gases. We use coal to restore the heat. The ores at these two furnaces are almost the same, except in the matter of phosphorus, which has no effect.

Q. If these furnaces were operated so as not to consume more coke than is necessary and with no more blast and pressure than is necessary and with no more than you are using at the furnace in the same neighborhood, would they, in your opinion, furnish ample gas to run the boilers and supply the blast?

A. Yes.

Q. If there *rs* an excess of limestone this itself has a bad influence upon the burning of the gases?

A. Yes.

Q. If there is any defect in the gas from the furnaces in question it is impossible for it to arise from any defect in the machinery?

A. Yes; it cannot arise from that. Some cokes yeild gas richer in carbonic oxide than others.

Q. Do you know about the foundation of these engines?

A. Yes.

Q. What about them?

A. I saw them all put in and directed the selection of the bricks. There is nothing but the best hard brick in them, the best mortar. The foundations are laid down to the good hard pan of excellent character, so hard that at was dug up with great difficulty with pick-axes. They stayed there a good long time until they became solid before anything was put on them. They are the kind now universally used; the jar would loose the stones, the brick will not be loosened. I went there on Sunday last and examined them, and found that there is no crack in one of them, none given way;
177 the corners have been picked off.

Q. Did you ever see better?

A. I never did.

Q. We said something about the severe shock that engines receive by what we call this toggle joint, water in the cylinder preventing the complete revolution of the fly-wheel?

A. Yes.

Q. Did you ever know engines to be broken in that way, or did you ever visit any?

A. Yes.

Q. How many at once?

A. I saw at one time four that were broken.

Q. What kind of engines were they?

A. The same we had at the Lady Ensl-y and the Hattie Ensley.

Q. Were they good engines?

A. Very good.

Q. How were they disabled?

A. The steam cylinder was driven out of the housings.

Q. Was there any blame attached to the engineer in that case?

A. I don't know; I just went there to see them. They were made by the same manufacturers as mine. No kind of foresight or preparation could prevent breaking in cases of that kind; if the water is in the engine, and it is allowed to start off rapidly, and if the water is there in sufficient quantity, there is no power in the world that could withstand it; the toggle joint is the strongest power in mechanics.

Q. After the furnace was accepted, who was in charge there of the labor and materials about the furnace?

A. The superintendent, who was myself.

Q. Mr. Gordon came there to see about the blowing of furnace A?

A. Yes.

Q. What did he do in the way of preliminaries to blowing in furnace A with reference to the analysis of ores?

A. He wrote me that he wanted samples taken in a certain way and directed how they should be taken, and then he wanted the analysis made for certain determinations embracing all the materials usually found.

Q. He required analysis?

A. Yes. *Q.* He had only one ore and only fifteen car-loads of that on hand. I took a sample from that and had it analized and

furnished it to him. We did not receive the other ore in time to get an analysis. I obtained an analysis, said to be, from
178 another party. I don't know whether it was the true analysis or not.

Q. Did you furnish him with an analysis of the limestone?

A. I did.

Q. Do you know the analysis of the coke?

A. No; I did not get it in time to have an analysis made. We assumed one.

Q. Did you agree that the analysis should be assumed?

—. I did.

Q. So that the analysis of the ore you gave to Mr. Gordon was a correct analysis of the ore used in burdening the furnace, and so that analysis of the lime was correct, and the assumed analysis of the coke—so far as that was concerned—was the formula given by Mr. Gordon for burdening the furnace theoretically correct?

A. It was.

Q. Did you go over the formula given by him and give it your approval?

A. I did; it was in his office. He asked me to take a seat at his desk, and we went over it together and agreed upon the correctness of the formula.

Q. And under the assumption under which it was made, what do you say now?

A. That it was correct.

Q. Did Mr. Gordon have anything to do with the making of those analysis?

A. No.

Q. Have you seen and been over the figures made for the burdening of that furnace since its failure?

A. Yes, sir.

Q. And you still say that they were correct?

A. Yes.

Q. As a man experienced in iron-making, please explain to the court in as few words, as short a manner as you can, why and how the boilers in the furnace A failed.

A. It failed by reason of a deficiency of silica in the furnace or excess of lime, producing what we call a lime set. I will explain the operation in part. We start with this predicate, which, while not absolutely true, is true to the extent of our purposes; that no simple earth in the ordinary temperatures afforded in the blast furoce, if poor, will fuse or melt. The ores entering the furnace and other materials as well *as* contain varieos earths which we term "foreign earths," silica, alumina, and lime. All these earths are fused for the purposes of separating them from the iron and dividing them for the furnace. They cannot be got out except in a fused state; they must come out in a liquid form.
179 Hence the iron-master takes advantage of the af-inity which alkalies and acids have for each other, and by bringing the alkali and acid earth together in proper proportions in the presence of this high heat they readily fuse and furnish fuel for the furnace.

The foreign earths introduced in this case were composed of silica and alumina, the silica being an acid earth and the alumina a basic or alkali. We therefore use alkali earth in the form of limestone to supply the acid earth with their affinity to produce the matter to a liquid form. If the alkali or lime is *a* in excess of the amount required by the silica for liquefaction or proportionate to the liquid slag the excess *r*lips down to the bottom and remains in the furnace, the silica only takeng what it wants, and not only does it remain in part there, but the slag ceases to be liquid and becomes thick and stiff and the half of the furnace is filled with coke, held down to the bottom by this material reaching to the top of the furnace, and this slag lies in amongst this coke, and as soon as you get a sufficient excess of lime it will run along through the opening. It then cools and cannot go any further and must be pushed out. The way in which this occurred in this case was: This furnace was filled as usual with the blank, as we term it, of coke, with the proper amount of limestone to furnish the ash, and then the burden was introduced, gradually increasing until the furnace was full. The furnace then would contain in this mixture ore enough to produce possibly one hundred to-s of iron per day; perhaps not quite so much; I cosld not tell. Before any change in the combustion of the materials can be brought about into the bottom of the furnace this entire mass of material must be worked through the furnace until within eight feet of the top, so that there is absolutely no chance to get any heat till the material in the top is brought to the bottom. We find by subsequent analysis that eight such charges of 8,000 pounds of ore, 4,500 pounds of coke, and 3,400 pounds of limestone should have contained by the analysis applied by Gordon 1,651 pounds of silica, whereas by the analysis made by samples, taken a little later, and I believe before the furnace was blown in, they had realized 1,101 pounds of silica. Then, there was a difference of five
180 hundred and fifty pounds of silica in each charge—a deficiency of that much—therefore leaving the lime so excessive that the silica could not take it up and bring it out of the furnace. In addition there were other contributory difficulties. The blast was turned on on Saturday, the 18th d- of August, at noon. Sunday it commenced to rain, and on Monday there was a tremendous rain; the air was not only saturated to its fullest extent with water, but there was a mist. When the component parts of the slag are not in proper proportion to make it sufficiently liquid it is important that the highest temperature be used, as that gives more perfect action and tends to reduce the difficulty; but the blast absolutely chills the nose of the blowing pipe, and it will form on the nose of the blowing pipe what we term a butt. The slag requires between three or four thousand degrees of heat in these furnaces to be the drip slag, and iron would fail and then cool and close up the opening. That would cause a stop that would increase the difficulty. The men were nearly all inexperienced men. Those we had brought there had come. They were very poor in clearing these tweers; they did that for a long time. We had a great many contributory difficulties to contend with, the whole difficulty com-

ing out of not having connections and proper analyses to start with.

Q. If the analysis had been as that furnished to Mr. Gordon would your charges of materials have contained this silica, which you say was deficient?

A. Yes.

Q. And if that had been there would the chill have occurred?

A. No.

Q. Who made the analyses?

Q. The first analysis was made by J. B. Britton, of Philadelphia' and the samples were taken by myself. I objected to them as being unfit by reason of their hagh percentage of phosphorus. The president directed us to purchase ores for mixtures with these. I got another, so that I would have to use one-half of this particular oee. In the meantime they went on and improved the washing of this ore and made an ore that was not like that, withoot our knowledge, and we went on using it.

Q. You attribute the cause of the disaster entirely to the faulty analyses and those different samples?

A. Yes; to that entirely.

181 Q. Did Mr. Gordon give to that effort to blow in the furnace his personal attention?

A. Yes; I could hardly get him away to his sleep.

Q. Did he consult with you about everything?

A. Yes.

Q. Did you approve of everything?

A. Yes; I did.

Q. When did he give up the furnace as beyond recovery?

A. The Saturday succeeding the Saturday on which we blew in.

Q. Did you go on and make further effort?

A. Yes; I worked it all day Sunday and into the night—Sunday night—and finally had to give it up.

Q. Was Mr. Gordon ready to assist you?

A. He was ready to assist what he could, but there was no use.

Q. In blowing a furnace that has never been dried out and is not charged with heat state whether or not, in your opinion, this continual resistance and also the lack of silica would make it more likely to occur in a case of that kend than in foll blast.

A. Yes; when it is in full blast everything is hot, even to the foundations. If we stop and there is heat below we expect that heat to help. If the stoves are full of moisture it requires two weeks to eliminate that. It did in the Lady Ensley, and the water was coming down through the joints of the iron-work. That moisture must sensibly effect the working of the furnace.

Q. Explain the effect of such a spell of weather as that upon the furnace.

A. It would be much more disastrous.

Q. Why?

A. We had not yet arrived at the proper temperature; we had not any safe of heat to draw from.

Q. Now, we come to furnace B. Some time after that furnace B was undertaken to be blown in?

A. Yes.

Q. State whether or not furnace B was blown in well—if properly or not.

A. Yes; it was properly blown in. It went to making the very best of iron properly. We were in the same condition in regard to labor.

Q. How long did it so continue?

A. It was running successfully up to the time I left it, so far as the furnace was concerned. So far as the care of the iron
182 and the manipulation was concerned, they were having a great deal of trouble with it.

Q. State what those difficulties were and what they arose from.

A. We were unable to keep the furnace filled with the labor. It was necessary to slow the furnace down below what it ought to have gone at. Another very serious disaster: The sand we had in the casting-house was unfit for the purposes. When we would cast the iron into the sand it would boil almost at every cast. The sand is wanted for moulding. The water cannot draw down through the sand. When the iron comes into it it causes a series of rapit explosions and they increase in violence until the whole mass becomes involved and the sand mixes with it and becomes an immense mass that cannot be broken; that has to be removed before we can go on.

Q. How long did you have to stop?

A. Two or three hours or very nearly that. That had a very serious, disastrious effect. In connection we carried a large percentage of sulphur. It can only be removed in the form of sulphate of lime. Until the lime becomes excessive it cannot move the sulphur. Sulphur is the worst enemy we have to contend with so far as the impairment of the quality of the iron is concerned. A very small amount, from one-twentieth to one-tenth of one per cent., impairs it. When the furnace is started up again this mass would come down into the bot-om and stop the tweers and blowing pipes, and we had to clean them out, and then the iron would come loose in the tweers, and these difficulties came one after another. Those difficulties were nothing serious. They are very common and easily restored. We simply have to work along till we get a change of burdeniog. The presence of a high percentage of sulphur rendered it more to the taking up of the solid mass at the bottom, which was the proper —. The sulphur resists the lime. As soon as we began to have these troubles Mr. Gordon reduced the percentage of lime. As soon as we began to have these troubles Mr. Gordon reduced the percentage of lime in his mixture, which was the proper thing to be done, and the furnace was being restored as rapid-y under his management as it could have
183 been done under anybody?

Q. What kind of coke was used?

A. The Pocahontas in blowing in, about twelve hundred tons, and the Jasper.

Q. Was the latter equal to the coke at Pratt mines?

A. No.

Q. What percentage of sulphur was in the coke?

A. About two per cent.; the sulphur should be about one per cent.

Q. Do you know of any other furnaces that use the Jasper coke?

A. No; I used three car-loads when I got short of any other coke and I found the same difficulties, and it deposited in the bottom of my furnace very rapidly, and we had to tage it out in great slabs. It is about the same weight of iron and has in it what we term buckshot—little round, hard lumps.

Q. Furnace B was put in successful operation by Mr. Gordon under proper formulas for burdening a furnace?

A. Yes.

Q. What became of the iron that was made during these boils?

A. It was not put back into the furnace.

Q. What proportion of it went off?

A. A very large proportion.

Q. Was there any difficultn in transportation?

A. We were unable to get sand. We ordered sand from the Saulsbury mills, but they had a strike and about the time they got through with the strike the yellow fever broke out; but we went over and borrowed two *two* or three car-loads of sand from the Hattie Ensley to mix with this.

Q. What was the rate of the production of iron during that management by Mr. Gordon?

A. Five hundred and four revolutions per ton of iron mad>.

Q. Do you remember what day Mr. Gordon went into furnace B?

A. The ninth day of September, I think.

Q. Then he was supervising the furnace about thirteen days?

A. Yes; and during that time we used less fuel and made the best quality of iron I have ever seen.

Q. Were you there during his supervision of furnace B?

A. Yes; he did not undertake to manage the hands; I did that.

184 Q. All he did was to give general directions?

A. Yes.

Q. Did you approve of his directions?

A. Yes; except that he wanted to go faster.

Q. If it had not been for those boils, what do you think would have been the production of the furnace after the furnace got in fair operation?

A. I don't think I ought to tell because I don't think I would be believed. I think that it would have easily produced one hundred and fifty tons per day.

Q. What do you draw nour conclusions from?

A. We were restraining the production all we could, because we could not keep the furnace full. She would run at times one hundred and thirty tons per day, and we desired to restrain her all we could.

Q. Do you understand the arrangements of the steam mains in this plant?

A. Yes.

Q. Is there any need or necessity for more valves in these steam mains than there were?

A. No.

Q. Why?

A. We are able to cut out any pump, boiler, or engine with what we had. There were valves cutting off everything from the steam mains. It should not be cut off. If they had been properly covered there would have been no necessity for repairing them for a year. The valves would be likely to become corroded, and we always stop an engine long enough to repair the joints.

Q. How long would it take to repair those joints with such means as you would ordinarily have?

A. Not longer than thirty minutes; often in ten.

—. Have you the same character of joints where you are?

A. Exactly.

Q. Did yours there ever get out of order?

A. Some of these inside the engine got loose, but not those outside.

Q. What made the leaks?

A. The pipes were entirely naked, and it was the expansion and contraction caused from exposure. We had pipes of the same kind at the Silico furnace.

185 Q. Did you ever see connections made from the pump to the boilers outside of this main?

—. No.

Q. You know the general plan of this plant, do you not?

A. Yes.

Q. What do you think of the propriety of having bridges from one hoist to another?

A. I do not think there is any use for them. I never saw anything of the sort unless there were hoists put to run two furnaces; you can do that in furnaces like these.

Q. Do you know how the blast mains are arranged?

—. Yes.

Q. There are three stoves for each furnace, are there not?

A. Yes.

Q. How many stoves are usually supplied?

A. Usually there; sometimes two.

Q. Would two run one of these furnaces?

A. Yes. Q. We are producing considerably over one hundred and twenty-five tons and we have three stoves 18 by 50; the capacity of two stoves is one-third greater than three of these stoves.

Q. What do you think of connecting the blast mains all into one pipe so as to run the blast from one furnace into any other furnace?

A. I do not see any occasion for it and I do not see how the mechanical difficulties can be overcome sufficiently.

Q. With reference to those boilers, were they supported by the set wall near the boilers?

—. No.

Q. State whether or not those eye beams were *amole*.

A. Yes; the boilers all were erected before any brick-work was put in—entirely independant.

Q. Do you know what is called the cooling plates in the furnace?

—. Yes.

Q. State how they have to be arranged and how these were arranged. Were they packed?

A. No; we do not pack until we are ready to run a furnace; there is a recess left in the wall extending to within five inches of the inside of the wall; thoie cooling plates are made to slip in and take out at will. Water is made to circulate in pipes, the object being to prevent the water from cutting those brick.

186 Those are much thinner than the opening and have to be packed with clay; they are not packed until we are ready to blow in the furnace, because the clay in drying strinks; exposed only to the weather it will be weeks in drying and it is neglected. The ordinary way is to pack when ready to blow in and dry up everything.

Q. In the construction of these furnaces did you direct that these cooling plates be not packed?

A. Yes.

Q. Was there any defective brick-work in these furnaces?

—. No.

Q. What was the condition of furnace B when you turned it over to Mr. Chamberlain?

A. First rate. The day preceding that, at nine at night, we had a boil in the sand in front of the furnace and we were unable to resume operations until six the next night, when we did resume. This dripping gradually filled up the bottom, and we made one hundred and twenty-five tons, and the subsidiary made one hundred and twenty-five tons, I was informed.

Q. About what pressure were you then running?

A. We were running about four pounds pressure.

Q. How many revolutions per ton of iron?

A. About five and four and five revolutions. The engines were in fine condition and I think we were getting all the blast in the furnace. I will say in connection with that casting that if we cannot run six hours I always cast in four hours, so that I may make three casts in a shift of twelve hours.

Q. Did you discover any defect in brick-work in any part of that plant?

A. No.

Q. Now, as to the casting-house, were there openings in that furnished as per contract?

A. Yes.

Q. How was the iron to be carried out of this casting-house?

A. At the end opening.

Q. What are the openings in the cast-house for?

A. For air.

Q. How are those openings covered generally (usually)?

A. After the furnace starts iron plates are put down into them;

they are not always necessary, only when the openings are osed for going in and out.

187 Q. Do you know how these openings in this casting-house have been injured?

A. Pitching out these large masses of iron we had to get them out. Some of them weigh six or eight tons, maybe; they had to be pitched out through these openings.

Q. How does the cost of making iron in a new furnace usually compare to the costs of one of these in blast?

A. That depends on how the costs are kept. Some companies charge into the cost of making iron everything—grading, etc. The only amount that is charged should be charged against the making of iron. The iron costs much more the first six months than afterwards, and much more the first month than the first six; sometimes three times as much. It costs a large sum of money to fill the furnaces. There are a great many of those things that make the costs show up high on the books.

Q. If the water come over from the boilers and it is in the cylinder when the engine is running would it affect badly the steam packing rings upon the cylinder?

A. Yes; the water starts out and the steam follows it and works out.

Q. Do you remember that after the furnace was accepted there was some other material ordered to be used in their construction?

A. Yes.

Q. What was the amount of that material?

A. The amount stated was eleven hundred and some odd dollars; that was received before I left, but had not been put in use. It was afterwards put into the repairing of furnace A.

Cross-examination by Mr. WHITE:

Q. Was that a matter of your own knowledge?

A. Yes; I have been there and seen them in there.

Q. How long have you been engaged in iron-making?

A. Fifteen years. I began in 1873.

Q. In what capacity did you begin?

A. As secretary and treasurer and superintendent.

Q. Then your knowledge has been gathered from practical experience?

A. No; I have had both education and experience.

Q. Where did you study?

A. At home and in the office, and I had teachers at my

188 house—experienced men—among whom was William R. Thomas.

Q. Was he a student and a scholar?

A. He was a thoroughly well-informed and well-educated man.

Q. You were with the defendant company and its predecessor throughout the entire time those furnaces were being erected?

A. Yes.

Q. You say you examined the work weekly and sometimes daily?

—. Yes.

Q. You passed upon every part?

A. As often as every two weeks.

Q. And you were satisfied with the result of your examination every time?

A. No; I often objected.

Q. Well, as finally finished it was accepted?

A. Yes.

Q. You acted in good faith, believing it sufficient in every respect?

A. Yes.

Q. You undertook to do nothing in the matter of that inspection except to the extent of your authority under that contract?

A. No.

Q. And you declined to accept that furnace finally without instructions?

A. No; I did not decline. I said that would rather be sustained by some intimation of that character. I simply asked Mr. Gordon to wait until I could notify the president.

Q. And you did not undertake to accept it finally without this authority?

A. There was no occasion. I had the authority; all that I wished.

Q. You did not accept of the furnaces finally, except after hearing from President Coles in the manner testified to?

A. No.

Q. That was the letter of authority that you acted upon?

A. Yes; I acted upon the authority of the contract and specifications and the verbal authority the president had given me to accept it when completed.

Q. Why did you, then, desire or require an expression from any of the officers of that company that you should pass on that furnace?

A. It was a very important matter, and it would be more gratifying and satisfactory to me to have them approve the thing.

Q. If they had given you the authority and you had understood it to extend to the final acceptance of that furnace when completed, why did you desire or wish to have additional authority?

A. The same that I would in making purchases for the company—matters of importance. I would confer with the presi-
189 dent in ordering locomotives and buying rails; anything like that I conferred.

Q. Those conferences, then, were not for the purpose of getting further authority, but for the purpose of being sustained in your own opinion?

A. That is all.

Q. Then when the furnace was finally completed, you having authority to accept it and being satisfied, you wanted Cole to intimate to you that you were the man to receive it finally?

A. I preferred that.

Q. You preferred that he should say that you were the man to receive it?

A. Yes.

Q. You had a full understanding before that?

A. Yes.

Q. When Mr. Gordon came to blow in the furnace he demanded his final acceptance and you declined to give it until you had this intimation that you were the man to do it?

A. Yes; I immediately notified the president that I had accepted it and no objection was made to it.

Q. Then you were confirmed in your opinion that you did accept it?

A. When I was satisfied that there was no objection I accepted it.

Q. The president confirmed your view?

A. Yes.

Q. You acted upon that confirmation?

A. Yes; subsidiary to my authority.

Q. Then you acted upon the confirmation of your opinion by the president?

A. I don't know that I would be willing to testify that I might have accepted it if he had not assented. If he had said that I had no authority I would not have accepted it, but if he said nothing I would have accepted.

Q. You did act finally on that confirmation and made the acceptance?

A. It was based on that in connection with my contract.

Q. You accepted that furnace in good faith, believing that it was up to the requirements in all respects?

A. I did.

Q. Then you have the interest of opinion at stake in this case?

A. Yes.

Q. As any man has when he has given an opinion on a material matter?

A. Yes.

Q. And you — earnestly striven to maintain that opinion by all the facts that warranted it?

A. I think that word "striven" would hardly apply. I have made no effort not natural.

190 Q. Then you have been materially interested in point of failing in having your opinion sustained maintained if the facts warranted it?

A. I have been materially interested in my opinion that justice should be done.

Q. Do you think that would confirm your opinion?

A. Certainly.

Q. Do you believe that your opinion was right?

A. Certainly.

Q. And you sought by the means in your power to present that aspect to the court?

A. No.

Q. And you think that those men ought to have that money?

A. Yes, I do feel interested; I acknowledge that, not that I want them to follow my opinion.

Q. Then you have undertaken in this case to have your opinion confirmed by all the facts that warrant it? Not from any interest

outside the interest of opinion on which you think rests the justice of these parties?

A. Not from any personal interest that I had in the matter.

Q. I ask you if you have not been active in this matter in presenting the facts in the case because you thought that justice to these parties required it.

A. I do not think that I admit that I have been specially active.

Q. Then you have willingly produced in the trial of this case all the testimony and facts bearing upon the matter confirming the correctness of your opinion, believing that the justice of the claim of these parties should be furthered by it?

A. Yes.

Q. You have suggested many facts and matters that were in your experience that bore upon these questions?

A. Yes; I think I might say that I have.

Q. You say that you think that the Lady Ensley is the best furnace in the South?

A. I do.

Q. That is the furnace that you have charge of?

A. Yes.

Q. How long has that been in blast?

A. Five months.

Q. Who was the contractor for the construction?

A. J. P. Withrow.

Q. You do not use the same engines as at the coal furnaces?

A. No; not the same plan or make; not the same engines.

Q. Do you use the same make of boilers?

A. No.

Q. Is the furnace constructed like one at coal furnaces?

191 A. It is a little smaller and not alike in many little details. It is very similar in its lines and heat.

Q. Do you burn the same kind of coke?

A. No.

Q. Do you use the same kind of iron?

A. The same family—brown hematite.

Q. You have been running slow ever since you started?

A. Yes.

Q. What capacity is it constructed for?

A. One hundred and twenty-five tons, about; it has the same blowing power and considerably less stove power.

Q. They are generally constructed with a certain capacity?

A. It is the capacity of the manager. You might have the same manager at two furnaces and then they would produce in proportion. There is no way that you can estimate the capacity of a furnace unless you know the capacity of the man that is going to run it. If you know that you are going to have a good manager then the design and equipment will very well measure the production.

Q. What was that furnace of yours designed to produce?

A. Never was any estimate made that I know of; usually furnaces of that size produce from eighty to one hundred tons per day.

Q. When you contemplated the construction of these coal furnaces did you not have in view any particular output?

A. Yes; one hundred and twenty-five tons. At the same time the practical result throughout the South is not one hundred and twenty-five tons, but falls down to between eighty-five and one hundred, caused by the management and improper material.

Q. And these coal furnaces were disigned to yield an approximate output of one hundred and twenty-five tons each per day?

A. Yes; with good managemeot.

Q. You did not contemplate that they should be badly managemed?

A. No; we do not contemplate anything about the management.

Q. In a durnace that is designed for an output of one hundred and twenty-five tons per day you say that the usual result is not more than eighty or ninety?

A. In a furnace that is the size of the Lady Ensley, which is smaller than usual.

192 Q. What is the usual average of a furnace of 125 tons capacity?

A. It will come down to eighty-five or one hundred, figuring the capacity upon good management.

Q. The practical management falls short of the theoretical?

A. Yes; the practical result falls short.

Q. In a furnace designed to produce 125 tons that design is based upon the scientifil calculations that engineers go by. When you construct a furnace yoo take into consideration all matters pertaining to iron-making?

A. Yes: the scinece and the practice.

Q. And you say that the result in the South is about twenty per cent. less?

A. Yes.

Q. Io a furnace that is designed to produce one hundred and twenty-five tons if the yield is one hundred and fifteen it is practically well managed?

A. I do not considere it so.

Q. Then you consider the management all throughout the South as poor?

A. Yes; as an average.

Q. What furnace besides yours comes up to the designated output?

A. The Pioneer, at Birmingham, comes up to it. The Woodward doei very good work. The Silico has been doing work beyond its capacity. The Suwanee, at Cowan, has been doing work fully up to its capacity.

Q. The majority comes below, however?

A. Yes.

Q. Does the construction of the cok-, lime, or ores have anything to do with the o-tput?

A. Yes.

Q. With the same management of furnaces with different quali-

ties of coke, limestone, and ore the ootput would be different regardless of management?

A. Yes; with the same intelligence in the men it woold be different.

Q. Then you think that the management of a furnace, the size of the coal fsrnace, with the ore used there and the Jasper coke and limestone, is not good management when you produce one hundred and fifteen to one hundred and sixteen when the capacity is one hundred and twenty-five tons?

A. I do.

193 Q. Using the ore — is used in the coal furnaces and the Jasper coke, what do you think would be the output at the Lady Ensley on an average?

A. I think I could put oot one hundred and thirty tons average per day with normal work, without putting it under whip sr spur. We are producing now about 140, one hundred and forty, having just been running up to oor supply.

Q. What could you have produced if you had ore supply without whip or spur?

A. 150 tons, in my opinion.

Q. Then yoo admit that you could not with the use of those ores and the Jasper coke produce as much as you do now?

A. Yes; I do. I think it would cut me down about twenty tons.

Q. That would be no evidence of bad management?

A. No.

Q. The Lady Ensley is designed so that the gas can make heat under the boilers?

A. So far as the supply of gas goes.

Q. The appliances at each furnaces *is* supposed to be sufficient to utilize the gases?

A. Yes.

Q. While the machinery has nothing to do with the creation of the gases, the manner of burning those gases has a great deal to do with their utilization?

A. Yes; it may have.

Q. One furnace may be designed so that it can consume every particle of gas?

A. Yes; with correct handling.

Q. And another may be made so that it may not do it?

A. I suppose it might. I have never seen one where the gases coold not be burnt.

Q. How far does gas travel in being constructed under yoor boilers at the Lady Ensley? Was it designed that the gases should go under the boilers at the Lady Ensley?

A. It was designed that they should all be burned in the combustion chamber. I suppose five or six feet long.

Q. What space under the boilers did that gas have to fill in the operatio-s for heating?

A. It has about 16 feet long and makes two passes.

194 Q. Thirty-two feet?

A. Yes; it makes just about equal to two full passes, including the lenght of the combustion chamber.

Q. These boilers at the coal furnace are better than at the Lady Ensley?

A. Yes.

Q. You had additional ones put in at the Lady Ensley?

—. Yes.

Q. Then a difference in the make of boilers will make a difference in the capacity for getting heat by gases?

A. Yes; not because of the construction, but because of the difficulty of — in the production of combustion common to them. What I mean is, if the boiler is so constructed that you can't keep it externally clean.

Q. How far do the gases travel in the other boilers at the coal furnaces?

A. About the ſame distance; possibly a little further.

Q. How far is the new — at the boilers at the Lady Ensley?

A. The combustion occurs at about the same distance, 64 feet long. If the gases travel only ten times the area and only one-tenth the distance it is equal to one-tenth the area and ten times the distance.

Q. You said yesterday that these designs were submitted to certain contractors. Did you say that the contractors submitted them themselves first?

A. The contracts were submitted for adoption and examination, and, after the several plans and specifications had been gone over, such alterations were made as they desired, and then the contractor went to work and prepared his bid.

Q. The designs and specifications were submitted by different contractors for the purposes of making bids upon whichever was adopted?

A. Not after the adoption, but before.

Q. They submitted their plans and specifications and their bids?

A. Yes.

Q. They presented the plans and price at the same time, making such changes as their judgment dictated?

A. Not at the ſame time.

Q. Before this contract was made there was a bid made to the officers based in these that had been submitted?

A. Yes.

Q. Then on the one that was accepted the contract was based?

A. Yes.

Q. These were the original plans and specifications of
195 Gordon, Stroebel and Laureau, except to the extent of the alterations?

A. Yes.

Q. Then on their being accepted this contract was entered into?

A. Yes.

Q. You were not employed by the company at the time that you and Warner acted as a committee for the adoption of the plans and specifications?

A. I suppose I ought to say that I was. I had not been engaged for any *per* period, but when they did make the contract they dated it back to *th* that time; that was to compensate me in this matter.

Q. Then you went into the supervision of the construction of that plant?

A. *A.* Yes.

Q. Your work in that matter was critisized unpleasantly by some parties to the company?

A. By Withrow, Gordon's competitor.

Q. During all that time the company assured you of their confidence in your good faith and judgmeot?

A. Yes.

Q. The contract provides for ninety per cent. to be paid for on receipt of your reports?

A. Yes.

Q. That was paid during the period of construction?

A. Yes.

A. The work of constructiong furnace A was finished August 8th?

A. Yes.

Q. When I say that then furnace A was charged you had analyses made of the ores you had on hand?

A. No; I had analyses made of the first fifteen car-loads that were received.

Q. Then you used that ore in blowing the furnace?

A. No; we did not use any of that; we could not get to it; we used ore that came in from the mine?

Q. And you acted upon the *c* assumption that the analysis was correct?

A. Yes; and we had analyses of another that the Sheffield Co. had. We afterwards found it incorrect.

Q. Then you used the ores to which you did not have the analysis and the ore that that company had an analysis of?

A. We filled with one-half McLahahan and the other Sharp's *S* ore.

Q. You just acted on the assumption that the other would be the same ore?

A. *d*Yes.

Q. What do you call loading a furnace?

A. We call it a charge. A certain amount of each kind of material together.

196 Q. After that you made an analysis and found an assumed analyses and the actual were different?

A. Yes.

Q. When was that?

A. I don't think that I could give the date after blowing in the

Q. A

A. Yes. t how long afterwards?

Q. And n[illegible]y long; as soon as we had received a sufficient quan- those operation[illegible]s soon as he could make his determination.

A. None of it a[illegible]x the time more definitely than that?

put back.

A. I do not think that I can.
Q. Was it before or after furnace B was blown in?
A. Before, I think.
Q. How many days was furnace B blown in after furnace A?
A. Some little time; about three weeks.
Q. During that time you had the other analysis made?
A. Yes.
Q. A chamist will make a wrong analysis sometimes?
A. I think not. This chemist makes two analyses and then takes the average between them.
Q. Then this mistake came from some other man than a chemist?
A. No; I think that he had the wrong sample.
Q. How do they usually select samples for analysis?
A. The usual method is to get a little and take it up without very much care; and they will pick up for samples lumps here and there. We though- that we were using the same ore; it was from the same mine. The first analysis was correct of that sample.
Q. If I understand correctly, you had analysis made of this ore that the Sheffield parties had refferred to and another analysis of this McLanahan ore and the samples were different from the first?
A. There was a difference in the quantity of the silica and alumina.
Q. What is silica?
A. Silica is decomposed quartz rock.
Q. Come down a little.
A. It is principally sand and acid earth.
Q. And the difference in of analysis was the difference in silica?
A. That was not all that occasioned any difficulty.
Q. What was the difference in per cent.?
197 A. The first analysis, sixteen and twenty-seven hundredths per cent. silica in the McLahan ore, the sample containing 11 and $\frac{93}{100}$ *% per cent.* silica, the difference being four and thirty-four one-hundredths per cent. silica.
Q. That was the principal reason of failure?
A. Yes; the difference was not *amole* in this analysis, but in the other—the Sharp's ore?
Q. What was that?
A. The first analysis gave 15 and thirty-hundredths; the second analysis gave 8 and $\frac{9}{100}$, the difference being 7 and $\frac{29}{100}$ per cent.
Q. Who selected the samples?
A. I did, the last ones
Q. How?
A. I took a darkey and a wheelbarrow and a spade and had the darkey to shovel at different places, and at every few feet I took little and put on the wheelbarrow. He then pounded it all red powder, then took up one-half of iron and divided it in the r and so on till he got it reduced to the required size; sent t chemist. from the
Q. You do not know how the first was selected?
A. No.

Q. That is the way you account for the incorrectness of the analysis?

A. No; only on the *apothesis* hypothesis that the sample did not represent the ore. I had not the sample they had.

Q. Take the ores in this state as they come from the mines, are they not very subject to these variations?

A. Yes; but not so extreme as this.

Q. You acted upon the assumption that those things were correct. How did it cause the failure?

A. There was too little silica; that produced a lime set. There was less silica than the analysis we used showed; that caused us to put in too much lime and there was too much matter in there.

Q. Did those concomittant circumstances materially interfere with the work?

A. Yes; very materially.

Q. If you had not had that bad weather and you had had experienced labor, then you would probably have corrected that?

198 A. Not probably, but possibly.

Q. Then the labor and the rain was "the straw that broke the camel's back"?

A. Yes.

Q. How did you fill up that furnace at first?

A. We first take out the ashes, fill with cord-wood—put in from five to ten cords, I suppose—then we would build up to, probably, 15 ft.; we filled it in the center with one stick against another; we lay it in the bottom like a rail fence, but when we get enough wood we set wood around against the walls to protect the walls; then we put in about forty tons of coke, with the proper amount of limestone, and then put on a light burden at first and gradually increase it.

Q. What was the burden when you started?

A. I do not remember. They run the light burden up about every ten charges until the furnace was full. We did not have on a full burden when we got to the top.

Q. What kind of burden did you have at the top?

A. I think we had about eight thousand pounds ore and forty-five hundred pounds of coke and something like three thousand five hundred pounds of lime.

Q. What would have been a full burden?

A. That was as much as ought to be in that work. In regular work there would be about ten thousand pounds of ore, properly handled.

Q. How much lime or coke would that consist of?

A. The lime would depend on the analysis of the materials. I would not like to venture an opinion on any assumption of amount.

How much coke?

furnace about 45,000 pounds of Pocahontas coke.

Q. About that furnace was blown in were you aware that with

A. Not very much coke you could carry a burden of forty-five hundred quantity of ore and coke and ten thousand pounds ore?

Q. Can't you [illegible]

Q. You had used it before?
A. Yes.
Q. What did you do then?
A. Went ahead with it and blew it in?
Q. How?
A. We first fill the furnace with kindling, placed in different parts, and then fire this kindling and turn the blast in, at first just about equal to natural draft, and then, as the fire gets larger, we
199 increase the speed beyond natural draft, increasing gradually. At first the blast is warmed but very little; that is the way we do it—as near natural blast as possible.
Q. How long after you put the draft on before you got the slag?
A. I should think that it was some time the next day. I have no recollection.
Q. About how many hours?
A. I could not tell; it takes a long time for the wood and coke to burn out.
Q. How long before you got iron?
A. I don't remember; not quite as quick as usual, because we produced slowly.
Q. When you blew the Lady Ensley in did you put the blast in in the manner you have described?
A. No; we did that differently. The Lady Ensley had been built a good deal longer.
Q. Then you were a good deac longer getting iron in the Lady Ensley than you were over there?
A. Yes, because we shut it up.
Q. What was yoor idea in doing this?
A. To dry out the furnace.
Q. That was the only porpose you had?
A. Yes; of course we would get the benifit of whatever up, but the object was to dry it out.
Q. You said that Gordon consulted with you about all these matters preparatory to putting the furnace in blast and the management after you did do that, and that you approved of all that he did. There was no duty upon you under yoor employment to do that, was there?
A. Yes; Cole charged me to render him all the assistance I could.
Q. And that was onder the direction of Cole?
A. Yes.
Q. You say that from the time that Gordon put furnace B in operation it ran smoothly and all right?
A. It ran very well, best of any furnace I ever saw, up to the time that it showed excessive lime, and he applied the proper remedy.
Q. About how much ore did he make the first ten days?
A. I don't know; never make much the first ten days up to
200 was not weighed; I have no memorandum of the amount of ore he used the first ten days.
Q. He run it up to September the 22nd.
A. Yes.
Q. How much iron did he make up to that time?

A. He made during the last week, five and eight-tenths days, a total production of five hundred and ninety-eight and ninety-two hundredths tons, based upon ore reduced, estimating at fifty per cent. metallic iron. This gives an average yield of one hundred and four tons per day of twenty-four hours.

Q. Why do you count only five days?

A. The balance of the time it was idle.

Q. In that calculation you have deducted the time lost by reason of those boils?

A. Yes.

Q. Is that ussal in measureng the output of furnaces?

A. We are not estimating; we are reporting.

Q. Is there any difference in the usual report and that?

A. I can only testrfy to what I do.

Q. Do you do that?

A. I do. Every moment of the time is lost is reported. The report shows the actual number of hours and minutes that the furnace was in action.

Q. Then when you make during twenty-four hours one hundred and thirty tons of iron, say, and you have stoppedt wo hours during that time, do you put that result as being for twenty-two hours or twenty-four hours?

A. We put the iron made in twenty-four hours under altual action of twenty-two hours. That is all the iron we make in twenty-four hours.

Q. That is the way you estimated this?

A. Yes.

Q. In the general report of making, say, eight hundred tons of iron in a weeek, is it your custom if you stop — or ten hours during that week to count it five or ten hours less during that week or charge?

A. If I was reporting to the papers I would say that we produced so many tons of iron in so many houhs and minutes.

Q. You deducted from the time that you charged against the furnace and casting time.

A. Yes; the daily report that comes into my office always shows that.

Q. And that is the custom at every other furnace?

201 Q. Now, you say that as much as half of that iron put out during the last week was in the shape of iron got in the boils?

A. No; I did not say it, but it is my opinion that more than half was lost in the boils.

Q. The iron that gets in the boils can be accounted for?

A. Yes; it is there.

Q. And can be recast?

A. A[illegible]

A. Whe[illegible]one of that iron was put back into that furnace during the Pocahontas?

dred pound[illegible]t all; there was very large pile, but none of it was

A. Yes.

Q. In your report that you made to the company what did you *report* put in reporting iron?

A. Pig-iron, salable and in shape to sell.

Q. That furnace, then, so far as it itself was concerned, was — a healthy condition from the time that Gordon blew it in to the time he quit, with the exception of lime in the furnace?

A. Yes; and the irregularity—that occasioned more or less burning at the tweers.

Q. You did not state yesterday that you had any thouble with furnace B, except as to those boils?

A. I think I did state that the lime accumulated on the walls and sloughed down.

Q. Then the furnace was not in a healthy condition when Gordon quit there?

A. It was suffering from excess of lime, but not in a serious condition. He had already applied the remedy to the condition before he quit.

Q. What put the furnace in that condition?

A. I will refer to my report to the company.

Q. Why cannot you remember what was the cause *u*ithout referring to your report?

A. I stated yesterday that I wanted to be certain that I was right. Reading from a letter that I wrote at the time, on the 20th of September, which was the second day before he turned it over, I see that the furnace was going slowly on account of excess of lime, and

202 — occasion of that excess was, in part, impaired cleanliness of material, and, in part, high percentage of sulphur in the coke, requiring the lime to be carried up to the limit of safety *safety.*

Q. Those are the reasons?

A. Yes.

Q. Don't you think that Gordon's anxiety to produce iron with the Jasper coke was the reason?

A. Possibly that might have produced the result.

Q. It is possible in the management of a furnace for it to get in these conditions?

A. Yes.

Q. If you carry it up to the limit of safety that is a necessity?

A. Yes.

Q. Then such results or accidents are possible in the management of a furnace?

A. Yes; it is not unusual for such conditions as these to occur.

Q. Was there not dissatisfaction in the company with Gordon's ...e management of affairs, and was not that the reason that they asked him to submit to being relieved?

A. I do not know.

...ays; it

Q. You knew the officers and knew the status of matters ...mount of standpoint of the company?

A. Yes.

Q. Gordon was relieved, was he not?

...e?

A. Yes.

Q. And because they were not satisfied?

A. Yes; I so understood.

Q. Mr. Chamberlain had nothing to do with these matters, had he?

A. I understood that he gave his advice. I saw him talking to the president.

Q. Were you not making more iron during the last part of Gordon's stay there than at any other time during his management of furnace B? Was the furoace going down or coming up in production?

A. He was making more iron, I think, the first half than the last.

Q. That was because you were tr-ating for excess lime?

A. Yes.

Q. How much coal was being used under the boilers there by Gordon and you during that time?

A. I don't know; considerable coal. We had a large pile.

Q. You can measure that the same way you measure ore, can you not? The reports you make are approximately correct, are they not?

A. We made no report of the amount of coal. It is all charged up, whether we have a large amount or not. All the coal that comes into these two locomotives is to be supplied in this case.

Q. Were you using fifteen hundred pounds of coal to the ton of iron?

A. I do not think we had that much. My best opinion
203 would be that we could not use that amount.

Q. How much would you use?

A. I suppose probably five hundred pounds per ton of iron made at twenty-five tons of iron per day.

Q. What facts do you figure to come to that conclusion?

A. I had to divide twenty-five tons.

Q. Why do you suppose that you use twenty-five tons per day?

A. It was just my opinion.

Q. Then on matter of opinion you would feel that you were authorized to contradict a statement?

A. No; not my mere opinion against any reasonable evidence to the contrary.

Q. If that furnace was properly constructed and the management properly utilized the gases by the appliances, how much coke would be necessary to be used in the production of a ton of iron if the coke that is used there is the Jasper coke?

A. I think that it ought not to be expected that the gas should run the boilers; I should say at least a car-load a day. You cannot base it upon the steam properly.

Q. If a furnace properly constructed and properly managed used those ores and that coke, under ordinary circumstances what would be the reasonable requirement as to coal?

A. I am unable to state.

Q. Those furnaces are constructed with a view to use the gases for fuel?

A. Yes; as far as they go.

Q. What amount of coal was thought to be necessary for the use of them in the calculations that you all made?

A. We did not know whether much was to be used and did not make any calculation on the coal question.

Q. If the fuel has no combustible materials they cannot be burned?

A. No.

Q. In the construction of furnaces in this State for the use of the ores of this quality spoken of it is not contemplated that the *uies* will yield steam proportionate to the fuel necessary?

—. Yes.

Q. What is that?

—. The proportion of combostible to incombustible materials is about twenty-eight per cent.

204 Q. Have not the men who construct the furnace in view that it will be necessary to use a given amount of coal?

A. No; there is no given amount about it.

Q. Do they approximate or do they figure on everything?

A. The furnaces are constructed for the combustion of gas and coal. If the gas is enough they use it.

Q. Then it is expected that there will be some gas that can be used?

A. Yes; more or less.

Q. What proportion of gas to the coke that will be used?

A. Under the proper management those furnaces would make that steam with the gases without any coal.

Q. You are acquainted with nearly all the cokes that are used?

A. Yes; a large share of them.

Q. Take one of those as the basis of your calculation.

A. Taking the Jasper coke, I do not think that any man can run a furnace and make the gas to supply his furnace. It would lack very largely. It would require a car-load of coal every twenty-four hours, with the best of management.

Q. The Jasper will make iron?

A. Yes.

Q. And good management with this will produce one hundred and twenty-five tons per day?

A. Yes.

Q. How much coal supplement will have to be used?

A. Four hundred pounds of that coal will have to be used to supplement the gas to make the heat per ton of iron.

Q. Then if a person shows that in his management, using Jasper coke, he gets enough gases to run his furnace by using four hundred pounds of coal, it shows that he has utilized all the gases he could, does it not, and that there is not *and that there is no* mismanagement on that point?

A. It does not necessarily follow. It might follow that my opinion is wrong.

Q. You have stated that with proper utilization it would take four hundred pounds, in your opinion?

A. Yes.

205 Q. You say that with the proper utilization of these gases, using the Jasper coke, that the gases would not supply ssfficient amount of fuel, and that a certain amount of coal, which would be about four hundred pounds, would have to be added to the ton of iron, rating the production at one hundred and twenty-five tons per day?

A. Yes.

Q. If the actual operation of that furnace shows that there is no more than four hundred pounds of coal used, supplementary to the gases, then you would judge that the gases were being utilized?

A. Yes; another compensation comes in there that is based on the supposition that the furnaces is to be run for the production of high rates of iron, not low grades. We use less lime and produce better iron, in other words. My opinion that the gas would supply the steam was based *based* on the fact that a large excess of lime would have to be used to eliminate the sulphur to make good iron.

Q. How much coke do you use to the ton of iron in your furnace approximately?

A. By my last report we are producing a ton of iron with two thousand and sixty pounds of Pocahontas coke per ton, about twenty-one hundred pounds average.

Q. Then why does not 2,400 pounds of Jasper coke make as much as 2,100 pounds Pocahontas coke?

A. You simply mean that 2,400 pounds of Jasper coke cannot be used in the production of gas to the extent that 2,100 pounds Pocahontas coke can; in my opinion it cannot.

Q. How many revolutions were your engines running in making a ton of iron?

A. By the last day's report, 520 revolutions.

Q. How many to the minute?

—. Twenty-four to the minute each engine.

Q. Is that number of revolution- used at all furnaces?

A. No, sir.

Q. And that is all the revolutions required to make 125 tons per day when the furnace is properly handled and in good working order, when there is no obstacle?

A. Yes; that supposition is based on the work actually done by Gordon in one week with the difficulties he had.

Q. What condition can the furnace get into even under the management of a practical scientific man that it will require

206 more revolution- of the engine to the top of the iron?

A. The furnace can be charged much too low with ore; he may take his burden off one-half or one-third so that he multiplies his coke in proportion to his ore; then he must blow a large amount of air to the ton of iron made.

Q. Then a furnace may get into such a condition that it will require properly more revolutions of an engine than twenty-four per minute?

A. Yes.

Q. And those conditions may happen even under the management of a scientific competent man?

A. Yes.

Q. And when they do happen then this increased revolution would be resorted to?

—. Yes.

Q. Engines are made with the view of acting up to the requirements of those contingencies?

—. Yes.

Q. Then an engine is not given a greater power alone for the purpose of operating one up to the capacity of two because of the breaking of one?

A. Not necessarily.

Q. Then in building furnaces or in accepting the plans or specifications for furnaces in fixing the power of engines you have in view these contingencies that will require a greater amount of capacity than will be called for in ordinary use?

A. Yes.

Q. Then you accepted these engines upon the statement of the specifications that they would be guaranteed to run up to a certain number of revolutions under a given pressure?

A. No, I think not; I did not so understand it; I understood that they should run up to 45 revolutions under ordinary work, and that they should be strong enough to stand a pressure of ten pounds; but I did not contemplate that they would be run at forty-five revolutions carrying ten pounds pressure. We never have use for that speed and that pressure in good work.

Q. Then you accepted these engines as being of capacity to run forty-five revolutions under constant and regular work?

—. Yes.

Q. And when necessary to be operated under ten pounds blast pressure?

A. It is not a good practice with a coke furnace; with anthracite coal they run that regular rate.

207 Q. Why is it necessary at all to run up to sixty revolutions?

A. It is not necessary.

Q. Why is it that they guarantee it?

A. Just as we guarantee a boiler for two hundred pounds pressure when we do not intend that it shall have more than one hundred.

Q. Does that mean sixty revolutions per minute?

A. Yes.

Q. Does that mean ordinary work?

A. Yes; at fair, reasonable, ordinary work.

Q. What kind of test does this contract comprehend?

A. My idea would be that the engine should be set up and tested to a speed of sixty revolutions per minute under a fair, ordinary pressure of three or four pounds per square inch; merely tested.

Q. Then you understand these specifications to mean that that

engine can be tested in ordinary work at sixty revolutions with, say, from three to five pounds pressure?

A. I should say about four pounds.

Q. That does not mean that it will stand work at that rate?

A. No; I think not.

Q. To what extent does work have to go in being tested?

A. Just a short time.

Q. As the occasion demands, or what?

A. The test—I think that is a legal question.

Q. Then the test, if I understand it, is working an engine for a reasonable length of time under ordinary circumstances?

A. No; under ordinary pressure you would not have the conditions; you have to toll down until you get the required pressure; the resistance is the same.

—. Does that test mean the work of an engine under this ordinary pressure?

A. Yes.

Q. You said yesterday that running three engines with twenty-four revolutions per minute each, if the blast went into the furnace, would reasonably or necessarily show that the furnace was being overblown or that there was too much air used.

A. Yes; or improperly charged for the production of 125 tons per day. I would say if we were blowing three at 27 revolutions, with the furnace properly burdened, that it would be an excess of that amount required for the production of 125 tons per day.

208 Q. Then if a furnace was properly burdened and they were running at that rate and were producing one hundred and twenty-five tons of iron per day, then what would you say, *præter*-mitting the inquiry, as to whether the blast goes in or not?

A. I do not think it possible for those conditions to exist.

Q. Is it possible for them to run three engines?

A. Yes.

Q. And it is possible to produce 125 tons of iron per day?

—. Yes; but it is not possible for all four of those conditions to exist in conjunctions, so that you are producing good iron.

Q. How much iron do you get out of these ores?

A. About fifty per cent.

Q. If you are making 125 tons of iron per day and get 50 per cent. and run three engines at 27 revolutions, what do you say?

A. I do not see that alters the case.

Q. You cannot get any more out than is in it, can you?

A. No.

Q. What do you call good iron?

A. Any gray iron that takes in foundry and gray forage iron.

Q. If you should go to a furnace, then, and find them operating three engines on one furnace making twenty-seven revolutions each per minute, producing 125 tons of iron per day containing of the finest quality that those ores make, realizing fifty per cent. material from the ore, could those conditions exist?

A. I think not; I should conclude that something was wrong or that the blast could not all be going into the furnace.

Q. If the blast was escaping under those conditions, would not the escape be self-evident; would it be detected?

A. There could a great many occur out of sight and hearing; the larger part would be likely to occur where they could be seen or heard. At the blowing engines in the discharge valves, out of which the blast passes on its way to the furnaces, there is a set in each end of the blowing cylinder. If thoie valves are leaking, the blast goes out and comes into the other end.

Q. Then there would be an average of escape not visible?

A. Yes.

Q. An engineer or manufacturer of iron furnace of compe-
209 tent knowledge and skill is aware of those valves?

—. Yes.

Q. Under what conditions did you see those engines running under eleven pounds pressure?

A. We had the valves closed down, testing them. We never made the test in actual working; we never had any condition of the furnace that would produce that; we did it artificially.

Q. When you went into your engine-room at the time you spoke of you found the shaft jumped on account of a wrong lead. How come that?

A. I do not know.

Q. Are they liable to get out of fix?

A. They require constant attention.

Q. Then that pumpeng is likely to occur whenever the lead gets out of fix?

A. Yes.

Q. And it is corrected by readjustment?

A. Yes.

Q. Would there be any difference in the sound of the thumping occasioned by the motion?

A. Yes; the difference would be perceptible. The shaft cannot lift until something has given a little; the lead might be wrong some little time before anything would give.

Q. The thumping would continue until something breaks or the lead is readjusted?

A. Yes; the thumping caused by water can remain but a very short while.

Q. Then the thumping ceases the moment the water is out of the cylinder?

A. Yes.

Q. And that is forced out in a very short time?

A. In a very few revolutions.

Q. And they are constructed so that the water can be driven out?

—. Yes.

Q. And the piston comes down and strikes this water—that is, this 36-inch diameter—and the water must all get around that, precisely the same as dashing a churn-dasher into a churn?

A. Yes; it can get around on one side; not on all.

Q. Do you think that a system of valves in the chain steam pipe

add anything to counteract the condensed water in the valves of the pipe that is not used?

210 A. It would depend on what boilers you are using. They are so constructed as to take steam from one boiler to any engine.

Q. Is not the space in which water can be condensed reduced?

A. Yes; but you have to take off your steam for all other purposes; you have to have it so you can run these others.

Q. The leads were properly adjusted when put up there?

A. Yes.

Q. You say that the brick foundations were not intended to afford any support to the boilers in the way of foundation supports?

A. No.

Q. And that the eye beams were sufficient?

—. Yes.

Q. Is it possible for those eye beams to be two or three inches lower in the center than when first put in?

A. I do not know any case.

Q. If they are, what would be your explanation of it?

A. I would be most inclined to think that they had a gas explosion under the beams. If none of these causes should exist I should conclude that it sprung down by carryong the water.

Q. They would be sufficient, although they sprung?

A. Yes.

Q. The opening of the cast-house was never made to throw out iron?

A. No.

Q. Do you know of any of these parties using it for that purpose?

A. It was used by myself.

Q. Did you bre[illegible]ll the openings?

A. I do not know; I broke a good many of them.

Q. Was there ever a furnace in which there was no boils?

A. We have one in which there has not been. It has been running five months.

Q. Do you think that there never will be?

A. No; there might be.

Q. Did you ever use brown hematite ore before?

A. Yes; the same family of ores are usedat the Chattanooga furnace, the Silico, the Cherokee, and the Sewanee, and here at both these furnaces.

Q. Did you use them alone?

A. Yes.

Q. How much coke did you use to the ton?

A. I do not remember; it is too far back.

Q. About how much coke?

A. It varied from 2,000 to 3,200 pounds per ton of iron made, according to the conditions of the coke.

211 Q. Can you calculate the amount of air it would take to make a ton of iron from any iron ores, knowing the quantity of coke?

A. Yes.

Q. Did you know before you used the Russelville ores how much blast it would take to make a ton of iron from the ores?

A. Yes.

Q. How?

A. I know how much atmospheric air it takes to burn a pound of carbon in good blast practice, and I know that I could give it good blast practice *and I know that I could give it good blast practice.* I would have to know the analysis of the materials that went into the furnace.

Q. Can you take coke with ninety-three per cent. carbon, one per cent. sulphur, and six per cent. ash and an iron ore containing 85 per cent. oxide of iron, five per cent. silica, two alumina, two magnesia, one manganese, and five per cent. of water, both coke and ore entirely unknown to you, and without seeing them can you calculate how much air and coke it will take to make a ton of iron?

A. Yes; if you complete the analysis.

Q. Well, suppose the analysis was completed.

A. Certainly.

Q. How could you do it?

A. Figure it out.

Q. What preparation of stock would you order as to coke, ore, and limestone if you had not seen it?

A. I would have the ores broken down to a small size; would prefer not exceeding four inches cubes; would not object if it was the size of gravel; there would not be any serious objection if the lumps were as large as your head; I would break the limestone to about the same size.

Q. Why would you have the ores broken?

A. We do not melt the ore; we reduce it and melt the residue; to enable one part of carbon in the molecule in the carbonic oxide to unite with the ore it must come in contact with it; breaking up the ore is to multiply the surface and aid in the union of these atoms of carbon and oxygen. We break up the limestone to hasten the heating by multiplying the surface and facilitate the elimination of the carbonic acid as little as we could. The coke usually comes in a size not objectionable; sometimes it comes in so that it has to be broken; another reason for breaking the limestone is that it gives a better distribution of it in the furnace.

212 Q. Does coke ever come to the furnace too large?

A. Yes.

Q. Why do you consider ce-tain coke to be too large?

A. Where it is too large it is not as well mixed with the ore and limestone as when better broken. It antagonizes proper mixture of material, and when it comes into the bottom of the furnace it should come as near as possible mixed together.

Q. Does all coke work alike?

A. No.

*A.* Some takes greater blasts than others?

*Q.* I suppose it does. I might say not essentially greater, either.

Q. You find that the scientific and practical result?

A. Both theoretically and practically there is no essential difference ; some coke is more cellular than others.

Q. You could not tell that without seeing the coke?

A. I could tell by an analysis which gave the specific gravity per ton the percentage of daily passes and composition.

Q. Can you tell the cellular formation in coke by analysis?

A. I do not know that it would be strictly analyzed. It is work usually going along with analysis.

Q. What is specific gravity?

A. It is weight compared with weight of water. The specific gravity would tell how much was hollow.

Q. Does the analysis of coke show that?

A. No ; but we get determination of coke and of specific gravity when we take an examination for our purpose.

Q. You do not look at the analysis?

A. No ; not the chemical analysis.

Q. If two of those engines were running twenty revolutions with only one six-inch tweer at a furnace and the pressure was only four pounds at the furnace what would be your conclusion about the condition?

A. I should conclude that there was not much stuff in the furnace.

Q. If it was full, what?

A. That there was a leak of blast. I never saw such a blast as that in a furnace?

Q. That condition of things could exist?

A. Yes ; you might blow two engines at 20 revolutions and not get over four pounds pressure ; probably you would not get that.

Q. Does air *get* become rarified when a vacuum is being introduced in a blowing cylinder?

213 A. Yes; sometimes it is filled with water.

Q. If the openings in the air cylinder are not large enough to admit the *the* air fast enough to fill the vacuum when being formed, would there be as many cubic feet of air discharged from the cylinder as if when filled with air in its normal condition?

A. No; if th*h* air pipes are not large enough you do not get a full cylinder.

Q. Are there more leaks between an engine and furnace in an old one than in a new one?

A. That depends on the care. In my furnace I tried to make them better and better year by year.

Q. Under bad management there are leaks?

A. Yes ; it is all in the management.

*A*. Did you state yesterday that the air produced was represented altogether by the re*n*olutions of the engine?

A. The air discharged into the furnace is not represented altogether by the speed of the engine. You have to take into account the clearance of the valve boxes, etc.

Q. With ordinarily good combustion of the gases under the boilers, can all the gases be burned and the boilers use the heat pro-

duced from them in travelling thirty-two feet as well as in travelling this rate?

A. There are compensations. If they travel over a space four feet wide and this long it is the area and time allowed for the gases to impart their heat to the boilers, and that is a question of lenght and depth and breadth. The gas never is all burned; part cannot be burned. If in a blast furnace every particle or molecule of carbon is perfectly utilized so that each will take up a certain amount of oxygen, then the furnace will act perfectly in its chemistry and you have an ideal furnace.

Q. What will be the per cent. of carbonic oxide gas and carbonic acid?

A. If there is absolutely perfect combustion no carbonec oxide gas escaped from it. There will be one hundred per cent. of the other if you do not take into account any other gas.

214 *Deposition of Frank Smedling, Page-* 1 *to* 11, *and of Porter Watson, Page-* 11 *to* 18. *Filed in Clerk's Office July* 19*th*, 1890. *A. W. McCullough, Clerk.*

(Copy.)

215 FRANK SMEDLING.

Direct examination by Mr. GUNTER:

Q. What is your business?
A. I am a machinist.
Q. Where are you employed?
A. At the Hattie Ensley furnace.
Q. Have you ever served as an apprentice?
A. Yes, sir.
Q. Where at?
A. In Norway.
Q. How long have you been engaged in that work?
A. All my life.
Q. How old are you?
A. I am thirty-eight.
Q. How long have you been in Sheffield?
A. About three months.
Q. What experience had you in blowing blast furnaces prior to the time that you went to Sheffield?
A. I was several years in Ohio.
Q. At what place?
A. At Briarhead.
Q. You say you have been in Sheffield three months. During that time did you make any visits over to the furnaces run by Mr. Chamberlain?
A. Yes; I did; have been over there two or three times.
Q. What do you call throwing an engine out of gu[illegible]ge?
A. Uncoupling her when she is running at full s[illegible]peed; that shuts off the valves.

Q. Suppose that there is steam inside of the cylinder, what is the effect of uncoupling?

A. It causes compression.

Q. State whether or not that is the proper management when running at full speed.

A. No; it produces a shock to the machinery.

Q. The larger the machinery the greater the shock?

A. Yes.

Q. How many times have you seen that done?

A. I have seen that done here at this place three times.

Q. Did you ever see the engine stop in any other way?

A. No; the right way is to shut off the steam by the throttle and let it stop gradually.

Q. When was that?

A. About two months or six weeks.

Q. When an engine is uncoupled in that way, although it may be going at high speed, how quickly does it stop?

216 A. Before it passes the center. It cannot make another stroke.

Q. If it is going at thirty revolutions a minute, that is sixty half strokes?

A. Yes.

Q. Suppose it was going, having been uncoupled, at thirty revolutions per minute. At the middle of the half stroke it would stop instantly—almost within a half a second, would it not?

A. Yes.

Q. As a machinist, state whether you would call such management gross negligence or not.

A. Yes, I would; or want of knowledge in the people making the engines.

Q. Would any machinery—would even the best machinery stand such shocks?

A. No; the best would not stand it long.

Q. Now, Mr. Smedley, when the furnaces are stopped for the cast, state if the pressure there in the blast cylinder—does it not waste away?

A. Yes.

Q. So that when the engines starts afresh after some considerable stop there is no pressure in the blast cylinder?

A. No.

Q. After a stop, then, or after the cast, and stopping for some time and this losing of the pressure, how should it be started?

A. Generally slowly. It should not be started at forty or fifty or sixty.

Q. There is no blast pressure to resist it?

A. No.

Q. How did you see them starting off those engines?

A. I have seen the valve being left just as it was and start off at a speed of fifty or sixty revolutions per minute.

Q. Is that the proper — to start the engines?

A. No.

Q. Why?

A. Because there might be condensed steam in the engines and a certain amount of water, which would be liable to break something.

Q. Did you ever hear any thumping or pounding about them?

A. I have.

Q. What was the cause of that?

A. It was caused by condensed water in the steam pipe before passing into the cylinder.

Q. The water will condense more or less when it stands
217 for some time?

A. Yes.

Q. Suppose the engine is running at full speed and it is uncoupled on the down stroke—coming down on the down stroke—state what the effect will be and why it will stop before reaching the center.

A. Because of compression.

Q. What would be the effect upon the connecting rod?

A. It would lift the shaft.

Q. Where—what shaft?

A. The main shaft. The end of this shaft would be lifted.

Q. What effect would that have on the pins that hold the shaft down?

A. It would have a great effect. It might break them.

Q. What effects would such shocks as that, or of water in the cylinder, in the running of an engine, have upon the whole machinery?

A. It would give it all a shock; more so in the steam cylinder.

Q. Might it not break the bed plate?

A. Yes; it is liable.

Q. Did you ever in your experience before see large, massive engines at blast furnaces uncouple that way while in full speed?

A. No.

Q. Do you know who was the engineer on that engine?

A. I do not know the engineer. I guess I could tell him if I saw him. It was not the same one all three times; but I don't know the names. I only walked around there looking about.

Q. What character of foundation is best for engines?

A. A bed foundation.

Q. What kind of mortar?

A. I could not tell if I saw any; can't say.

Q. You are working at the Hattie Ensley furnace. Is that under the charge of Mr. Dowd?

A. Yes.

Q. What is the diameter of the cylinder, if you know?

A. It is thirty-six inches.

Q. What is the length of the stroke?

A. Four feet.

Q. Do you consider your engine ample for your furnace?

A. Yes.

218 Q. How do the engines at the furnace in charge of Mr. Chamberlain compare with the engines at your furnace?

A. They seem to be the same.

Q. State whether or not two engines are ample for one of those furnaces.

A. There are only two at the Hattie Ensley.

Q. Did you ever see valves put into the main steam pipes?

A. No; not the extra.

Q. Did you ever see connections for pumps or hoisting engines or other machinery requiring steam except to the steam pipes?

A. No.

Cross-examination by Mr. WHITE:

Q. You say you do not know either of the men?

A. No.

Q. Are you not acquainted with either of those men?

A. No.

Q. How come them to stop the engine at that time?

A. It was casting time.

Q. You say that on three different occasions you saw them?

A. Yes.

Q. How far apart were the times that you saw them and when was it?

A. I could not mention the day; it was within three weeks; about six weeks or two months ago.

Q. There were two different men?

A. Yes.

Q. And you saw one once and the other twice?

A. Yes; one of them had a darkish moustache.

Q. Are not those engines made to uncouple that way?

A. Yes; the best part of them are.

Q. They are made so they can be uncoupled?

A. Yes.

Q. And you never saw one uncouple in that manner before?

A. No.

Q. What is the purpose of making them so that you can uncouple in that way?

A. You can get the water when it has been standing a day or so. In case an engine has been standing you can put the hand lever in and work it up and down a dozen times.

Q. You saw them started and being stopped three in the
219 manner you named?

A. Yes.

Q. And they run them as high as forty, fifty, or sixty?

A. They started the first as high as fifty; the other was about forty. They started one off at fifty revolutions a minute and the other at forty, and by the time he started it the one at fifty checked down, and when the last one started the other two checked down to, say, thirty-five.

Q. They started as high as forty or fifty?

A. Yes.

Q. Did they start the other at forty or fifty?

A. They started the last one at, say, thirty-five, and all three run thirty-five after that, I guess.

Q. Are you guessing at the number?

A. I can pretty near guess.

Q. Then you are guessing, are you?

A. I can guess pretty good.

Q. Well, are you guessing at the number of revolutions?

A. Yes; for I did not go there for any purpose and I was astonished to see it. I just went to look around.

Q. But after you found out you told Mr. Dowd, did you?

A. No; I told Mr. Watson and he might have told Mr. Dowd.

Q. If an engine was made to run at fifty revolutions a minute, ten pounds blast pressure, how would starting it off at fifty revolutions with that amount of pressure hurt it?

A. Well, I suppose you would stop at half a stroke, and you couple her up and open up the valve. She gets a sudden force of steam, and whenever water has been condensed during a stop it will cause a certain pounding or thumping and will hurt the engine to a certain extent.

Q. Now, just suppose there was no blast pressure against it and it was running at fifty revolutions, how would it hurt the engine?

A. It would hurt it just the same.

Q. Did you notice the construction of those valves—those throttle valves?

A. No.

Q. Did you notice whether they were so constructed that
220 you could turn on the full force of steam at once?

A. No; the steam was left in the valves in the engines; the throttle valves were left for perhaps a week that way.

Q. Are all blast engines made that way, or is it a peculiar construction?

A. I never saw them handle engines like that before.

Q. Are blast engines made so that they can let on the full force of steam at the start without opening the throttle?

A. I don't know of any that are built that way; every engine is built to start up gradually.

Q. Are those engines made to let on steam in a manner different from ordinary blast engines?

A. No.

Q. Have the engines at the Ensley furnace got the same arrangements for letting on steam?

A. Yes; but I never saw it done, for it would break the engines down.

Q. In these engines is there any arrangements to let the steam out of the cylinder without opening the throttle valve?

A. No.

Q. Are there any of those arrangements on these engines?

A. I do not know; I never saw one.

Q. How did they start those engines?

A. By lifting the valve and coupling her up and let her go.

Q. You stated that it was customary to pump or force the water out of the engines after they had been stopped before starting up again?

A. If you start up slowly the water will go out in a few strokes.

Q. If you start up suddenly, what would be the result?

A. If you start up suddenly it will cause more compression; the water is more liable to break something if the engines run so fast.

Q. Is that the usual manner of getting water out?

A. Yes.

Q. Is that custom resorted to when the engines only stop fifteen or twenty minutes?

A. No; you start them up slowly.

Q. When they stop for flushing or casting?

A. You start them slowly with the throttle valve.

Q. At the time you speak of, were the water cocks open or shut?

A. I could not say; I did not go down and see; I don't know.

221 Q. Suppose the cocks had been open would the accumulated water there during the time of stopping have been sufficient to have caused pounding and thumping enough to cause damage?

A. Yes. Well, the cocks are in the cylinder as a rule. I did not see them in the steam pipes. The water becomes condensed in the pipes.

Q. When the water is condensed in the pipes and you start up the engine the water follows into the cylinder with the steam?

A. Yes.

Q. In starting an engine in that way would there be any likelihood of breaking the head in the blowing cylinder?

A. No; not the head in the blowing, too.

Q. You say the two engines do the work very well in the Hattie Ensley?

A. No; at the Lady Ensley.

Q. Do they run the same kind of engines?

A. No.

Q. The same size?

A. Yes.

Q. Do you think they are heavier or lighter?

A. About the same.

Q. How are those engines fastened down; how many holding bolts are there?

A. I think there are six. I can't say.

Q. Six or eight?

A. I could not say.

Q. More than four?

A. Perhaps only four.

Q. You do not run those engines?

A. No.

Q. Did you ever run an engine at a blast furnace?

A. Yes; I have run a turn when an engineer was sick.

Q. How long would that amount to that you have run one altogether; would it be two days?

A. You might say four days.

Q. Did you ever build a foundation?

A. No; but I have built blowing engines.

Q. Why is brick foundation for an engine better than stone, made out of large stones?

A. I can't say. I see that they use brick. I believe that they are best, but I could not say why exactly, except that everybody would not use them.

222 Q. If brick were laid in a foundation of cement that you could crumble in your fingers would that be better than stone?

A. I don't know. I am not a bricklayer or anything like that. I only go by what people use most. I would not know one foundation from another hardly.

Q. Then you do not know anything about foundations? Is that what you say?

A. Except from what I have seen in use. I have seen foundations built and have been there and put engines on it.

Q. Suppose an engine was running regularly, hour after hour, and on the escape-steam pipe you saw water coming out what would you attribute it to?

A. High water in the boiler.

Q. Then it is an indication that the water is passing to the engine for some cause?

A. Yes.

Q. What would be your conclusion, that water was coming into the engine or not?

A. It would be caused by water coming in.

Q. Have you had any experience with the Babcock & Wilcox boilers?

A. I have with the Babcock.

Q. What did you use for fuel?

A. Natural gas.

Q. What is natural gas, gas that comes out of the ground?

A. Yes.

Q. Where was that?

A. That was at a rolling mill.

Q. When you were at these furnaces did you examine how the steam pipe was constructed between the engine and boilers?

A. No.

Q. How far is the place where you work from these engines?

A. About two or three hundred yards; quite close by.

Re-examination by Mr. GUNTER:

Q. If the water, in considerable quantities, went over with the steam into the engine could it or not escape sufficiently out of the water cocks?

A. No; I don't believe that it could. It depends on how much goes over.

223 Q. If it did not get out fast enough, what would be the effect?

A. It would break or pound.

Recross-examination by Mr. WHITE:

Q. You say that those conditions were caused by thumping or pounding. Would not the thumping or pounding caused from any cause be of sufficient loudness and vibration to put the man who was working the engine in notice of that fact?

A. Yes.

Q. Any pounding of the engine that would break the bed plate, the man at the engine would know that it had happened?

A. Yes; but he might not know that it had happened? The sudden rush of water might break the bed plate.

Q. He would know that there was a shock, but might not know the effect of the shock, might he not?

A. Yes.

Q. When an engine is working regularly, is there any likelihood of any water coming into the cylinder without the engineer knowing something about it beforehand?

A. Yes.

Q. How can it do it?

A. By high water in the boiler.

Q. How could it get high?

A. By pumping too much in it. It gets there gradually. When the water gets up to a certain height in the boilers the engine sucks it out of the boilers.

Q. How can a large quantity of water come into an engine in that way?

A. Perhaps it has been laying in some pipe that is not connected with the engines and there is no circuit. There is plenty of causes for it.

Q. When the engines are running regularly the pipes from the engine to the boilers are full of steam?

A. Yes.

Q. How can a large supply of water get in there?

A. It does not take a very large body of water to break an engine. Half a gallon, say, sounds like a large body of water in an engine, while it is not.

224 Q. Would not the piston force that out of the escape pipe without any trouble?

A. No.

Q. What would it do?

A. It would force it out gradually, but not all at once.

Q. Can the water get into the engines any faster than the pumps can pump it?

A. No.

Re-examination by Mr. GUNTER:

Q. Did you notice the thumping yourself?

A. Yes.

Q. You can hear them start off suddenly that way?

A. Yes.

Q. Could you tell at the distance you were from the engine whether an engine is run off suddenly or gradually?
A. Yes.

Recross-examination by Mr. WHITE:

Q. In starting up blast furnaces, does that start the engine at a greater rate of speed than they are permitted to use afterwards?
A. No.
Q. How is it that they were started at fifty and let down at thirty-five?
A. Because she has to work against the other two engines and the pressure in the boiler pipe.
Q. How long does it take to get slowed down that way?
A. It does not take long.
Q. How long?
A. Three minutes or two minutes, as near as I can guess.
Q. Won't it do it in a half a minute?
A. It depends on how quick he starts the engines.
Q. It can be done just as quick as he can step from one engine to the other?
A. Yes.
Q. Then the length of time is the time he is going from one to the other?
A. Yes.
Q. How far apart are they?
225 A. About six feet, I guess.

Re-examination by Mr. GUNTER:

Q. Is not the shock to an engine from starting off suddenly instant?
A. Yes.
Q. Would not the shock be just as great if all the engines were started at the same time, instantly?
A. Yes; the shock would be just the same.
Q. If you start them all at once, they could not run that fast, could they?
A. No, sir.
Q. Why could they not run that fast?
A. Because of the pressure in the blowing pipe; there is the same resistance.
Q. Suppose that you start all at once, could they not be run at fifty?
A. Yes; if you have the steam.
Q. They are constructed to furnish steam for all three at the same time?
A. Yes.
Q. And all three engines for any furnace might be started instantly together?
A. Yes.
Q. And could all run at the same speed?
A. Yes.

Recross-examination by Mr. WHITE:

Q. Now, you say that all three could not start at that speed?
A. No.
Q. Because the same resistance is there?
A. Yes.

*Porter Watson.*

Direct examination by Mr. GUNTER:

Q. Where do you live?
A. In Ohio.
Q. What is your business?
A. I am at present engaged at Sheffield; I am a furnaceman at the Hattie Ensley furnace.
Q. What does the furnaceman do?
A. A little of everything; he has charge of the furnace, the running management of it.
Q. What experience have you had as a furnaceman?
226 A. A good deal of experience.
Q. How long have you been connected with furnaces?
A. Something over twenty years—twenty-one or two years.
Q. How long have you had charge of a furnace at once?
A. I have had full charge four or five years.
Q. Did you have charge at any time of the furnace—that is, under Mr. Chamberlain?
A. I had the management while Mr. McIlwain was sick for about nine weeks, and two weeks while he was absent.
Q. During that time did you control the blast and regulate the burden of the furnace?
A. Yes, sir.
Q. That was furnace B, was it?
A. Yes.
Q. What quantity of iron did you make in one week there?
A. The best week there was nine hundred an- fifty-two tons. There would be a little discrepancy between their books and mine. The yardman put the Saturday's iron in for Sunday, and the Sunday's in for Saturday.
Q. What was the greatest day's output?
A. One hundred and fifty-eight tons.
Q. How many engines did you run?
A. Two; they may have run three parts of the time, but were not running but two then.
Q. If that plant was all running, would not any two engines have more effective force than if only one furnace was running?
A. Not two engines would have.
Q. Would they not have more steam?
A. Yes.
Q. The steam would be more regular and better?
A. Yes.
Q. State whether or not, in your opinion, two of these engines are

sufficient to run one of those furnaces, making, say, one hundred and twenty-five tons per day.

A. Yes; if they are kept in repair.

Q. All machinery has to be kept in proper condition to get its effect out of it, does it not?

A. Yes.

Q. Did you or not have charge of the engines?

227 A. No; we had a master mechanic.

Q. Who was that?

A. We had three different ones.

Q. During that nine weeks who was there?

A. Jim Partlow was there during that nine weeks.

Q. How long were you at the furnace?

A. Six months and two days.

Q. During your stay there six months state whether or not the operation of those engines became less effective than they were at first.

A. Yes; they produced less blast. They did very well while Partlow was there, but when Stephenson came they got worse and worse.

Q. Was that the reason that you put on three engines?

A. Yes.

Q. If the engines had been properly cared for would they require any change?

A. Not if the valves are kept in repair. Of course, the valves and packing will wear out.

Q. In all the engines?

A. Yes.

Q. If the engines were properly attended to in all respects would they lose power simply from being used?

A. No.

Q. What amount of saving do you think there would be in steam effectiveness by using the whole plant instead of one-third at once?

A. I cannot tell exactly; there would be a good deal of saving; be more regular steam.

Q. Explain how, by using all instead of part, the supply of steam would be more regular.

A. When we take the blast off one furnace the gas immediately ceases going to the boilers. There is nothing to make steam while the blast is off without firing. If two or three are running there is no time but what there is a plenty of gas going to the boilers.

Q. And in that way the supply becomes more regular?

A. Yes.

Q. Are there not savings in other respects? In reference to the pipe to the pump, is not the radiation from the pipe and the loss of steam as great when one engine is running as when two or three are running?

A. Yes.

Q. Did you come to the furnace after Mr. Dowd left?

A. I came the 28th of November. I do not know when Mr. Dowd left.

228 Q. That was after Mr. Chamberlain took charge?
A. Yes.
Q. How much boiler power did you use during that week that you made one hundred tons in one day?
A. Two batteries and a half, or five boilers.
Q. Suppose all of the furnaces had been running, state whether or not, in your opinion, you could have dispensed with any of those boilers?
A. I think two batteries or boilers with two or three furnaces would run it.
Q. You think that the extra boiler was absorbed in irregular operations of some kind?
A. The regularity of the gas with two furnaces would make more steam than the irregularity with one furnace.
Q. Did you notice these engines at that place?
A. Yes; a good deal.
Q. Are they in charge of Mr. Dowd?
A. Yes.
Q. How do they compare in size?
A. They are just the same.
Q. Which do you think are the best and strongest?
A. Well, I don't see why one should be stronger than the other.
Q. In your opinion, are these engines as strong and effective as engines of that size usually are?
A. Yes; they are as strong and effective as the engines that I have been in the habit of using.
Q. At any time that you were at that furnace, state if you saw any mismanagement of the boilers.
A. Yes; they carry more water than I like to carry in boilers at a time.
Q. State whether or not you have seen the water above all the gu*a*ges.
A. Yes; once.
Q. Was that while you had the management?
A. Yes.
Q. Was that during these eleven weeks?
A. I think it was somewhere about the time of these eleven weeks.
Q. Did you hire and discharge those men? Did you have control over them?
A. To a certain extent, I did. I had charge in the daytime and Mr. McIlwaine's brother had charge at night.
229 Q. Have you ever seen the shaft of those engines being lifted up?
A. Yes.
Q. Did you notice any pounding of the piston?
A. Yes.
Q. Have you at any time seen those engines uncoupled suddenly while in operation?
A. Once while I was there, and several times since I left there. I gave the engineer his orders at one time.

Q. Have you ever at any time seen them start off suddenly instead of slowly with the throttle valve open?

A. They almost always start the first engine off rapidly.

Q. Did you ever repair any joints in those steam mains?

A. Yes; I had nearly all of them repaired.

Q. What was the longest time it ever took to repair one?

A. It took from thirty to thirty-five minutes.

Q. Never more than thirty-five?

A. No.

Q. How many hands did it take?

A. Three or four at each joint.

Q. In running furnaces, how long do you stop to make casts?

A. It is owing to the kind of hole we have; from five minutes to a half hour, as a general thing.

Q. If you have joints to repair, state whether or not you can take advantage of those stops for that purpose.

A. That is when I made the repairs.

Q. Were you ever stopped on account of those joints?

A. No.

Q. Did you ever see steam valves in the main steam pipe at any place before?

A. I do not know that I did.

Q. Did you ever see connections made between the pumps otherwise than from the main steam pipe at a furnace?

A. No.

Q. They had a hoist, did they not?

A. Yes.

Q. State whether or not it is necessary that they should be connected by a bridge.

A. It would be very handy to have a bridge; if one would give out to fill the furnace from the other.

230 Q. If the furnaces were all going would not each have its own duties to perform?

A. Yes.

Q. Do you mean that it would be convenient to have a bridge only if one should give out?

A. Yes.

Q. Would that compensate for the expense of erecting such a bridge?

A. I do not know.

Q. Did you ever see such a thing?

A. In one instance—at Braddock's, in Pennsylvania.

Q. How many furnaces have you seen in your life?

A. About one hundred an- fifty.

Q. How far apart were those furnaces at Braddock's?

A. They were closer than these are.

Q. Did they have only one hoist there?

A. They had three connected, I believe.

Q. Do you know whether that one that you saw—and the only one—was a gallery merely for the purpose of getting on the top of

the stoves and from one furnace to another and not for the purpose of charging one furnace from another hoist?

A. I do not know what it was for. I don't know whether it was a mere gallery for persons or for fuel. They used it for getting around on top and for cleaning them.

Q. Was it not a merewalk way and was it not supported on top the stoves?

A. Yes.

Q. That would not do to transport coal and iron, would it?

A. I do not think it would in this instance.

Q. Then it might have been intended for a gallery for persons only?

A. It has been a good while since I have been there, but I think it would be too light for transporting coal and iron on.

Q. In this plant there is an arrangement on top of those stoves without the gallery that you refer to the Braddock instance?

A. Yes.

Q. Did you notice any irregularity in the supply of gas to
231 those furnaces?

A. Yes; there was generally a good deal of irregularity.

Q. What did you attribute that to?

A. To too high heats and too much lime.

Q. If the lime was the same all the time there would be no irregularity, would there?

A. No; there is two kinds of ore at a coal furnace, all thrown together. One has about seven to nine per cent. silica and the other has from sixteen to twenty-five per cent., and those are dumped together in the stock-house, and one day they are using one kind and the next the other; and that makes a very irregular running of the furnaces.

Q. And that makes an irregular supply of gas?

A. Yes.

Q. How does that make an irregular supply of gas?

A. Because you use more lime.

Q. Does one ore require more lime than another?

A. One requires twice as much as the other.

Q. How long have you been mixing these ores?

A. Ever since shortly after I came there. They were using half and half when I went there. They just use it as they come to it.

Q. Did you analyze those ores?

A. I have heard the analysis.

Q. In a well-regulated furnace is it not necessary that any change from one ore to another be considered in making up the burden of the furnace?

A. It is one of the most—I might say it is the most—essential thing about a furnace.

Q. If that is not attended to you are liable to get in too much lime or too little?

A. Yes.

Q. State whether or not the gas from a furnace where there is too

much or a great quantity of lime used is not difficult to burden and affords less heat than gases from furnaces where less lime is used.

A. Yes.

Q. Why?

A. Well, I don't know. There are certain kinds of gases that go to make the heat and there are certain conditions that would make the amount of gas. That is one reason why they make poor

232 gas—they have too much lime.

Q. State whether or not you think that in the management of those furnaces the gas was properly distributed between the stoves and the boilers.

A. According to my way of running furnaces it is not. The high heats keep the furnace too hot.

Q. And carry too much to the stoves?

A. Yes.

Q. You examined an- looked at this whole plant?

A. Yes; but not so much as I might. I did not have anything to do with it particularly.

Q. Did you ever see one more complete in all its arrangements and parts?

A. I can't say that I ever did.

233 *Evidence of Porter Watson. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

234 PORTER WATSON.

Cross-examination by Mr. WHITE:

Q. You say you were at the Cole furnace for about six months?

A. Yes, sir.

Q. What capacity was it you acted in for about eleven weeks?

A. I was in the same capacity all the time I was there with the exception of the time McIlwaine was away, when I burdened the furnace.

Q. What capacity did you act in when McIlwaine was away?

A. I discharged his duties the same as my own.

Q. He is superintendent or foundryman?

A. Yes, sir?

Q. What part of the six months did those eleven weeks consist of—first, last, or middle?

A. In January there were two weeks and the last nine weeks were somewhere about the 6th of February up to in April.

Q. You went there in November?

A. Yes, sir.

Q. Then the greater part of those eleven weeks was toward the latter part of your service there?

A. Yes; I was there until about the 1st of June; left the last day of May.

Q. What part of the eleven weeks was the week that you produced this particular amount of iron—900 tons?

A. The week ending 15th January. That's the way I have it down in the books.

Q. They that was the first week of your service?

A. Second week.

Q. When was it that they commenced to use those ores indiscriminately—two different kinds of ores?

A. I think I had been there perhaps a couple of months.

Q. Then it was about the time you superintended in McIlwaine's place?

A. I can't remember. I think it was after McIlwaine came from the North.

Q. Then the week that you spoke of having made nine hundred tons of iron the average daily output was what?

A. It would be about 130 tons.

Q. What was the average output after that time when you were in charge while McIlwaine was sick?

235 A. It ran some weeks as high as 116 tons *tons* a day the last few weeks. I think it averaged about 110 tons.

Q. Then the average output was from 110 to 130?

A. Yes.

Q. Did it ever get up to 160?

A. No, sir.

Q. Didn't it get up to 158?

A. Yes, sir; at one time. That was during the first two weeks.

Q. Did you ever have charge of a furnace?

A. Yes, sir.

Q. Where at?

A. I had charge of two furnaces in Pittsburgh and a furnace at Pilot Knob, Mo.

Q. Did you have charge of putting on all the burdens at the furnace in Pittsburgh?

A. Yes, sir; I was superintendent.

Q. What part of the eleven weeks that you mentioned did you use three engines?

A. I presume I used three engines eight or ten days of the whole time; not more than that.

Q. The furnace had not then been running more than three months, had it?

A. I don't know about that. It blew in about August or September.

Q. What furnace were you running?

A. B.

Q. That was put *it* in September?

A. I say I don't know certainly when it was put in.

Q. How many batteries of boilers did you use?

A. Two and a half.

Q. Which was equivalent to five boilers?

A. Yes, sir.

Q. Did you ever run more than that?

A. We did, I think, for about two days.

Q. How much?

A. Three batteries.

Q. Then a part of the time you ran three engines with two and a half batteries?

A. Occasionally; as a general thing, two engines.

Q. You say you ran three engines part of that time with two and a half batteries of boilers?

A. Yes, sir.

Q. What amount of coal did you use when you were running these three engines with two and a half batteries of boilers—how much?

A. I don't know exactly.

236 Q. Well, about how much? It was your business to know, wasn't it?

A. No; not exactly.

Q. Is it not the superintendent's business to know how much coal they are using?

A. I presume it is.

Q. Then you did not know?

A. I was not superintendent.

Q. Well, about how much coal do you think was used?

A. I suppose somewhere in the neighborhood of a car-load, maybe a little more, during twenty-four hours.

Q. You were not on at night, were you?

A. No, sir.

Q. Do you know what was done at night?

A. It was pretty hard to tell what was done at night.

Q. Well, did you know what was done at night?

A. I did not.

Q. Why did you say that amount of coal you have named was used in twenty-four hours?

A. Because I knew from what coal came in.

Q. Did you not use 500 lbs. of coal to every ton of iron that was made?

A. I never figured it.

Q. What's your best opinion?

A. I don't think we did.

Q. Do you think you used 400?

A. I should judge we used from 300 to 400.

Q. Why did you use that much coal?

A. To keep up steam.

Q. Were these boilers designed to use that much coal?

A. I don't know what they were designed for.

Q. Does a well-designed and well-constructed furnace require 400 *tons* of coal to a ton of iron?

A. Not if it is blown in right.

Q. You blew that one right?

A. I suppose I did on my turn.

Q. That was half the day?

A. Yes, sir.

Q. Then you did not use as much coal in the daytime as the other man did at night?

A. I don't know as I did.

Q. You have no reason to believe he used more than you did?

A. Yes; I have.

237 Q. How much more do you believe he used?

A. I could not tell exactly how much.

Q. Twice as much?

A. No; I don't think he did.

Q. Half as much again?

A. Yes; I think he did.

Q. Why do you believe that?

A. Simply because he did not keep the furnace in the same condition.

Q. Then you were of better capacity for blowing the furnace than he was?

A. I did not say that; I think I know more about the business than he did.

Q. You think you did not use but 200 to 250 lbs. of coal to the ton of iron?

A. I didn't say that.

Q. How much did you use?

A. 250 pounds.

Q. Now, you stated awhile ago that you did not know how much coal you did use. Why do you think you used 250 lbs.?

A. From the amount that came in and the amount that was used.

Q. You saw the amount that came in and you saw how long it lasted, but you don't know whether he used more than you did?

A. I think he did; they generally had another man on for that business.

Q. Which business?

A. Giving coal to the boilers.

Q. Therefore you don't know what the man did with the coal?

A. He put it under the boilers.

Q. Did you watch him?

A. I did not.

Q. How did you come to the conclusion that it took more coal at night than it did in the daytime?

A. Because they kept more coalmen on in the night than they did in the daytime.

Q. You say that if all that plan was running the steam would be utilized in such a manner that six batteries of boilers would run six engines better than two batteries of boilers would run one engine?

A. I did not say any such thing.

Q. What did you say?

238 A. I said that the gases would be better utilized.

Q. You mean by that that you would get sufficient gas to run all of them?

A. Yes, sir.

Q. What did you say was the reason for that? Why you can better utilize the gases and get more steam?

A. Because there is always gas going under the boilers when two or three furnaces are running, while, when only one furnace is running a portion of the time, there is not any gas going under the boilers.

Q. Why, where does it go?

A. There is not any gas going anywhere when you are running one furnace.

A. Then while that furnace was stopped it would be utilized with the other two?

A. Yes, sir.

Q. What is it you said about the radiation from the steam pipes?

A. I said that it took just as much steam to heat up the steam pipes for one furnace as to heat them up for all the furnaces.

Q. Was not that regulated some way by a valve, so that only one-half of the steam would be used in running one furnace?

A. The steam pipes from the boilers to the engines were heated up just as much in running one furnace as in running all three.

Q. If there had been valves there to shut off all except the pipes from two batteries to two engines, would not that waste by radiation have been prevented?

A. Yes, sir.

Q. Didn't you state that in running all the furnaces in connection you would have more regulated and better steam?

A. Yes, sir.

Q. While Partlow was there he kept the engines in good condition?

A. He did.

Q. The engines had not been used to the extent of effecting their efficiency?

A. No, sir.

Q. Three months' use will not hurt an engine?

A. No, sir.

Q. Why did you run three engines part of the while? If
239 two engines were sufficient to run the furnace why did you put another one on?

A. Because I did not want to run the- higher than 38 to 40 revolutions; I never run them higher than 27 revolutions per minute each.

Q. How much would that be for each?

A. Two forties an- one-half.

Q. Then you didn't get any more by running three engines at 27 than you would by running two engines at $40\frac{1}{2}$?

A. No, sir; just the same.

Q. Why didn't you run these two engines?

A. Because it is not good for an engine to run too fast.

Q. Will it hurt an engine to run it up to its capacity?

A. I don't know that it will.

Q. Did you ever undertake to run these engines up to 45?

A. No; I saw no necessity for it.

Q. Then these two engines will operate this furnace by running $40\frac{1}{2}$?

A. It ought; that's the highest I ever went.
Q. You never run higher than 27?
A. Three 27's.
Q. How high did you run two of them?
A. Two 36's to two 39's.
Q. Why did you use two and a half batteries of boilers?
A. That's what they were using when I went there.
Q. Why did you use them?
A. Because that's what they were using when I went there and I had nothing to do with it.
Q. McIlwaine was not there during the 11 weeks of that time?
A. No, sir.
Q. Then the reason why you used two and a half instead of two was because McIlwaine had used them?
A. Yes, sir.
Q. Then you never tried to run one furnace with two boilers?
A. I never did.
Q. I believe you stated it could be done?
A. Yes, sir.
Q. And that without coal?
A. You would occasionally have to use some coal.

Q. Could these engines be run up to 45 revolutions with
240 ten pounds blast pressure with safety?

A. Yes; I reckon they could. I had rather run them lighter. I think they could be run with safety.
Q. Could they be run up to 48?
A. I would not care about running them up to that.
Q. Why?
A. Because I think it is too fast.
Q. You think detrimental results would follow?
A. It might and might not.
Q. You believe it beyond the capacity of the engine?
A. No; I do not believe it beyond the capacity, but I do not think it is safe to run any engine as fast as that.
Q. Then you don't think it safe to run any engine up to its capacity?
A. I had rather think not.
Q. Do you think it safe to run any engine up to its full capacity?
A. I guess it would be.
Q. Do you think it would be safe to test these engines up to sixty with ten pounds blast pressure?
A. I don't know whether it would be or not? I never saw a furnace that would need that.
Q. You have not got any scientific knowledge of the capacity of an engine?
A. No, sir.
Q. Then when you state that two engines and two batteries of boilers are sufficient to run that furnace, it is your opinion based upon practical experience?
A. It is.

Q. How many times did you see the water too high in these boilers.

A. They carried more water than I would carry all the time.

Q. Is not there a difference in opinion in operating furnaces as to the amount of water that the boilers should carry?

A. Some little difference in opinion; yes.

Q. But at one time you saw the boilers full according to the glass *guages* on them?

A. Yes, sir.

Q. Is it not expected that sometimes in the operation of
241 boilers that they will get too full of water?

A. They may sometimes, but it is not necessary.

Q. Isn't it usual and customary and isn't it expected that in the management of steam machinery of that kind that the boilers will at times get too full of water?

A. Sometimes; yes.

Q. They have appliances to measure it?

A. Yes.

Q. They have appliances to discharge it?

A. Yes, sir.

Q. What did you do when you found the boilers too full?

A. Blew it off.

Q. How long does it take to blow off the water?

A. A very short time, owing to the size of the blow-cocks.

Q. How long according to the size of the blow-cocks of these engines?

A. Two minutes.

Q. Can you always tell exactly how much water is in the boiler according to the glass *guages*?

A. Not exactly.

Q. Do- not the *guage* pipe often indicate that the water is higher than it really is?

A. I don't know that it will, unless the water gets to foaming; then it sometimes shows it a little higher.

Q. When was it that you say that you saw the boiler full?

A. I don't remember when it was. I know it was the time when Wm. Clark was attending to the water.

Q. Was that the time you had charge?

A. I don't remember; I think it was, but I am not positive.

Q. Was any damage done from it that you saw?

A. No.

Q. There is not any way of damaging the machinery by having the boiler too full unless it passes over the engine?

A. That's all.

Q. If it passes over and gets into the cylinder it causes a thumping, does it not?

A. Yes, sir.

Q. Any common engineer would know it and correct it, wouldn't he?

A. Yes, sir.

242 Q. There is no danger of its getting into the engine if you blow it off from the boilers?

A. No; if you don't carry too much water in the boiler.

Q. Is there not more danger in letting the water get too low than there is in letting the water get too high?

A. Yes; there is danger in burning the boilers.

Q. Is not that more danger than to get over into the engine?

A. No; I don't think so. It is easier to make a boiler than to an engine.

Q. There is more danger of a boiler blowing up when the water is too low than when the water — too high?

A. I don't think you could blow that boiler up.

Q. Then the boilers would burn up if they got without water?

A. Yes; I don't think you could blow them up.

Q. How long will it take that machinery to exhaust the water in the boilers from the high-water cock down to the lower one?

A. It will get down by making steam and going over to the engine in twenty minutes to half an hour.

Q. Is there not a way to stop the supply of water to the boilers when you find you have got too much in them?

A. Yes; just stop the pumps.

Q. Will take twenty minutes to use two or three boilers of water in these engines?

A. Yes, sir.

Q. Wouldn't it take more than two minutes for you to blow the water off?

A. No, sir.

Q. You say the engines over at Mr. Doud's furnace are the same size and weight?

A. I should say they are.

Q. What boiler capacity do you use?

A. I am not using any.

Q. You are not in charge of the furnace in operation?

A. No, sir.

Q. What boiler capacity is fixed to run these engines of yours?

A. We have four batteries to run two engines; eight boilers.

Q. What difference is there in the heating surface of the

243 boilers at the two places?

A. I think they are the same or nearly the same.

Q. Then you are preparing to use just double the boiler capacity?

A. No; I am putting in a battery of boilers, in addition to the others, before I start.

Q. If these engines at the Cole furnaces have been cared for properly they have the same capacity now as they had when put up?

A. Yes, sir.

Q. An engine does not lose its capacity by use if properly cared for?

A. No, sir.

Q. You say you saw that plant mismanaged by carrying more water than you would have carried. Do you mean that was just a

difference of opinion between you and the management of the furnace?

A. Yes, sir.

Q. They were of one opinion and you of another?

A. Yes.

Q. You stated that while you were in charge you had control of the men to certain extent. What was that certain extent?

A. I considered that I had the same control that I had at any other time.

Q. You had control of them in working the furnace, didn't you?

A. Yes, sir.

Q. You say you have seen the shaft while it was being lifted up?

A. Yes, sir.

Q. How much play has the shafting got upwards?

A. It ought not to have any.

Q. It will necessarily get some by wear?

A. Yes, sir.

Q. Can it lift above one-eighth of an inch without breaking the cap?

A. If the bolts are loose.

Q. You had the bolts screwed up?

A. Yes, sir.

Q. Is it possible to operate a furnace without these little things happening, bolts coming loose and parts of the machinery breaking?

A. No, sir.

Q. They do it in the best regulated furnaces in the world?

A. Yes, sir.

Q. Then it was not mismangement every time you saw the
244 shaft out of place?

A. No, sir.

Q. Machinery will break even when managed well?

A. Yes.

Q. You say you heard some pounding in the machinery. When was that?

A. At different times.

Q. You hear pounding in most all machinery sometimes?

A. Yes, sir.

Q. It is one of the irregularities that happen in the management of machinery, is it not?

A. Yes, sir.

Q. You say you noticed an irregularity in the supply of gases. You mean in the distribution of gas?

A. Yes; the supply.

Q. You mean by that that more gas goes to the heating stoves and less to the boilers than ought to?

A. That's my opinion.

Q. And the other men who were there differed with you as to the amount of gas that should go to the stoves?

A. Yes.

Q. If their theory was right it was not mismanagement?

A. No, sir.

Q. They believed in heating the stoves up to 1,200 degrees?
A. A great deal more than that.
Q. What did you believe in?
A. About 1,200 degrees.
Q. Did they believe in heating them higher?
A. Yes; up to 1,450 to 1,500 degrees.
Q. Did you ever test it?
A. Yes, sir.
Q. What is the highest point you ever found it?
A. 1,550, after it had been on half an hour.
Q. Some ironmen believe in running up to that, don't they?
A. If they burden the furnace up to that.
Q. How many times did you ever see it above 1,350?
A. A great many times; every hour in the day for a month.
Q. Think it was all the time for a month?
A. Yes, sir.
Q. What did you say caused the irregularity in the supply of gases?
A. Too much lime and too much high heat.
245 Q. How does lime have the effect of diminishing the amount of gas?
A. When you get the furnaces too limey you don't get as much gas.
Q. And when the furnace is working irregularly it makes more gas than when the furnace is working regularly?
A. Yes, sir.
Q. Then if some men are of the opinion that there is more gas when working regularly it is a mistake?
A. Yes.
Q. Did you ever study chemistry?
A. No, sir.
Q. Your knowledge was gained by practical experience?
A. Yes.
Q. What purpose does lime perform in a furnace?
A. Separates the dross from the ores.
Q. Did you ever complain to Mr. Chamberlain that these ores were improperly proportioned?
A. I don't know that I did to Mr. Chamberlain. I did to Mr. McIlwaine.
Q. When you were there in Mr. McIlwaine's place you didn't complain to him?
A. I saw him every day.
Q. Did you not go to Mr. Chamberlain for instructions about the management of the furnace?
A. I didn't go to anybody. I just went along as I had always done. McIlwaine was the man that I took instructions from.
Q. You didn't go to any one for the purpose of suggesting a change?
A. I talked to McIlwaine.
Q. You didn't talk to Chamberlain?
A. I don't know as I did.

Q. Didn't he give you the keys to scales and tell you to change it if you wanted to?

A. I did change the burden.

Q. During the time that you say that they commenced the indiscriminate use, didn't he give you the keys and tell you to change it?

A. No, sir.

Q. When did they give you the keys?

A. They never did.

Q. How did you change it?

A. I told Fred. McFarland to change it.

Q. What is the key to the scales?

A. A key to the door that is locked.

246 Q. What do they have scales for?

A. To weigh the ore and limestone.

Q. You had the key all the time?

A. I never had it.

Q. It was not locked, was it?

A. It was all the time.

Q. How did they get to it?

A. There is a little knob that you throw up to weigh the ores and another one to weigh the limestone.

Q. You had to have the key to change it?

A. I never changed it; I told Fred. McFarland to change it.

Q. That was under your management?

A. Yes, sir; part of the time that McIlwaine was sick his brother got hold of the keys. He worked at night and had charge the same as I did in the day.

Q. You complained about him?

A. I did.

Q. Your opinion was that you were a better man than he?

A. My opinion was that I was sober and he was drunk.

Q. You didn't get drunk?

A. I never got drunk since I came to this part of the country.

Q. The furnace run along all right during the 11 weeks you were in charge, didn't it?

A. Yes, sir.

Q. Also most of the time before the 11 weeks?

A. It didn't work so well.

Q. They made an average output of 100 to 110 tons per day?

A. I guess they did.

Q. Haven't they done it all the time from the 1st November up to the time the furnace went out of blast?

A. No, sir.

Q. What did they get down to?

A. The last two or three months a good deal below 100.

Q. How much?

A. Well, as low as 70 and 80 tons.

Q. Was that frequently?

A. Occasionally; within the last two or three months.

Q. When did you leave there?

A. The 1st of June.

Q. How do you know what has been the output?

A. I heard it.

247 Q. Then you are not testifying to your own knowledge?

A. No, sir.

Q. You do not know whether this decrease in capacity is attributable to the fact that they were making repairs in the machinery and pipes or not?

A. I do not know what it is attributable to.

Q. Why are you putting in more boilers at the furnace you are superintending if you think that two batteries of boilers of that capacity are sufficient to run the furnace?

A. When one set has to be cleaned it is necessary to have some other.

Q. Necessary or convenient?

A. Necessary.

Q. Is it necessary in the construction of a furnace to have more boiler power than is necessary to run the engines?

A. Yes, sir.

Q. Then a plant that is designed with sufficient boiler power necessary to run the engines is inadequate for furnace work?

A. Where there are three furnaces together there is hardly a likelihood of all three being run together.

Q. How many holding bolts are on the engines at your furnace?

A. Either four or six.

Q. Is it four or six?

A. I don't know, I am sure.

Q. Isn't it eight? Could you put six in well?

A. It may be eight. I am not positive. I know there are four.

Q. If you were to put a bolt right in the middle of the bed plate it would be right under the shaft?

A. You need not put it in the middle; you could put it on the flange.

Q. Did you ever tell Mr. Chamberlain, at the place where you are now, since you have been there that if you were constructing a furnace you would not have these boilers if you were made a gift of them?

A. I did; because I like the two flue boilers.

Q. Then, if you would not have a boiler of that kind, you do not want anything to do with it?

A. I don't know anything about them.

Q. What enabled you to confirm your opinion that two
248 batteries were sufficient to operate the engines and blow the furnace?

A. The experience that I had over there; we did do it.

Q. Then your whole opinion of their sufficiency is based upon the test you made of two an- a half batteries in operating two engines?

A. Yes.

Q. Yet you would not have boilers of that kind?

A. No; I would not put them in.

Q. What was the average yield of iron while you were running with these mixed ores?

A. We ran from 100 to 110 to 120.

Q. There was no perceptible difference as to the result in the output of iron?

A. Yes; the furnace would vary.

Q. What was the average percentage of iron that those ores yielded?

A. I don't know; I never figured on it.

Q. Was it not fully up to the yield made before you commenced that mixture?

A. I don't know; I never figured on it.

Q. How do you account for the fact that the gas was insufficient?

A. The gas was irregular.

Q. Was anything about the construction of the machinery or anything about the work done that would require this excess of coal?

A. No, sir.

Q. You think it came from the irregularity of the gas supply, and that came from what?

A. From excess of lime and high heat in the stoves.

Q. Why could you not correct that while you were running it and not use so much coal?

A. Because I didn't have full control.

249 *Testimony of J. G. Chamberlain. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

(Copy.)

250 & 251 J. G. CHAMBERLAIN recalled for respondents.

By Mr. WHITE:

Q. During the time that you have been around the engine-house there, during your administration, have you ever heard any thumping there?

A. I have.

Q. Did you investigate the cause of it?

A. I did as far as to enquire of the machinists and engineers.

Q. What was your conclusion?

A. After examining the connecting rods and seeing if they were being moved I came to the conclusion that this thumping that I heard was in these brass valves.

Q. You heard Mr. Doud's testimony as to the burdening of that furnace when it was blown in and the manner of blowing it in?

A. Yes, sir.

Q. Was that proper or improper according to your opinion?

A. From my opinion I think they went considerably beyond the danger line in blowing that furnace in.

Q. In what respect?

A. I think when the furnance was filled they had too heavy a

burden on it, and that they put the blast on the furnace too soon; I think they had too much lime for the average run of these ores.

Q. Do you know the character of the ores that they used?

A. I think that I have all the analyses that have been made.

Q. How do the ores that you have used compare with these in point of silica?

A. I think they have ten per cent. more silica than the ores that came in at first. The analysis shows that the silica runs from 7 to 27%.

Q. What do you mean by too much limestone?

A. I think that when you start a furnace that way and have it heavily burdened and put the blast on as soon as you get it fired you bring that burden down too quickly, and that you cannot handle a large amount of lime in a cold furnace as when you have it heated; that is where I think there is danger in having too much lime.

252

Q. Have you got data showing the product of that furnace during the time Mr. Watson was running it and just before and after?

A. I have it, but not with me.

Q. Do you recollect the product just before that time?

A. Yes.

By Mr. GUNTER:

Q. What do you take that from?

A. I take it from report that came from the furnace daily.

Q. Who made that?

A. Mr. Watson made it when he was in charge, and the weight of the iron was made by a man who weighed it; most of that time it was McNeil, who is now at the Ensley furnace.

By Mr. WHITE:

Q. What was the comparative product during the times I mention?

A. I can give you the figures very nearly. During Mr. Watson's administration they made 760 some odd tons and 780 some odd, I think about 16 tons per week more than Mr. Watson made, before and after the time he was in charge. That takes eleven weeks before and after the time he was there.

Q. What was the relative proportion of iron that was gotten from the ores during that time?

A. With Mr. Watson it was 49.63 %; with McIlwaine it was 49.60 %.

Q. What do you know about these boilers being cleaned in the manner and with the appliances provided during your administration? What was the habit and custom?

A. I know what the order was.

Q. What was it?

A. To clean the boilers every day, if there was any accumulation on them, by blowing it off with steam.

Q. Do you know to what extent that order was complied with?

A. Oftentimes when I have been there they were being cleaned in that way. I have examined them very frequently, and they didn't have any more dirt than would naturally accumulate during two days.

Q. Did you give any attention to the amount of water the boilers carried?

A. Only in this way: I have often looked at the *guages* to
253 see how they stood.

Cross-examination by Mr. GUNTER:

Q. Did not all boilers have three *guage* cocks?

A. They should have.

Q. Do you know the two weeks that McIlwaine was away and Watson was in charge of the furnace?

A. Yes, sir.

Q. Do you know the product of the furnaces during these two weeks?

A. I cannot tell you exactly without looking at the books, but I do know this, that it was not what Mr. Watson swore to the other day; his recollection was not correct in regard to it.

Q. How do you know?

A. From the furnace reports.

Q. You examined them and took a statement of the product of the whole eleven weeks he was in charge, and you could recollect that?

A. I did not say that I recollected exactly. I said that the difference was 16 tons per week.

Q. You cannot state how much was made these two weeks?

A. I can tell nearly but not exactly.

Q. You did not state anything about the water working in the engines, did you?

A. I do not know whether I did or not. I don't remember now.

Q. You saw these bed plates vibrating, didn't you?

A. I have seen the housens that were fastened to the bed plates lifting and moving.

Q. You did not see the bed plates moving?

A. I cannot say that I got down to see the bed plates moving from the foundations.

Q. What proportion of lime ought to be used in a furnace; what amount of lime does it take to flux silica?

A. It depends upon circumstances.

Q. What circumstances?

A. If you are blowing in a furnace or after you run it.

Q. If you have 125 lbs. of silica to each charge, how much lime would you put in to flux it in starting a furnace?

A. Twice that amount.

Q. You would put in for 125 lbs. silica 250 lbs. of lime?

254 A. Yes, sir.

Q. How much would you put in after she was running?

A. If the furnace was in good condition and I wanted to make a good grade of iron I would put in 2½ times as much lime as silica.

Q. Suppose you have a large quantity of silica in your furnace and have not got lime enough in it, what is the result?

A. You would make very poor iron.

Q. What effect has it upon the furnace when you have not lime enough?

A. It might have some effect to cut the brick-work.

Q. Does not too much silica in the furnace, when it is not fluxed, have the tendency to cut the brick-work?

A. It might.

Q. Don't you know, as a furnaceman, that it would have that effect?

A. I cannot say that I absolutely know it; I know that is the theory.

Q. So that in making iron you have got to go between two extremes, one of having too much silica and one of having too much lime?

A. Yes, sir.

Q. What is the margin of percentage?

A. I only judge from result.

Q. You don't know when you pass the danger line in having too much silica?

A. I don't know only in that way.

Q. Do you know it that way?

A. Yes, sir.

Q. When is it there is too much silica?

A. You see it in the quality of the iron?

Q. You have to wait, then, until you see the iron?

A. I have to do it.

Q. You could not get cinder or iron from the furnace until you had a run?

A. No; you would have to have some cinder; you get cinder before you make a run.

Q. Well, don't it run out, even when you get a spoonful?

A. Yes.

Q. You have run engines, haven't you?

A. No, sir.

Q. These?

A. No, sir.

255 Q. You have seen them run and know how they ought to run reasonably?

A. Yes; I know they ought to run reasonably well.

Q. If the boiler has three cocks they are generally set one above the other with some distance between them?

A. Yes.

Q. What do you get out of the top cock, if run properly?

A. A little water and a little steam.

Q. What do you get of the second cock?

A. Mostly water.

Q. If you get a little water and a little steam out of the first one, how could you get anything but water out of the second?

A. You sometimes get steam out of the second.

Q. What do you get out of the bottom cock?
A. Practically speaking, water out of the two lower ones. If you get steam out of the lower one you are getting water a little too low, and if you getting all water out of the top one you are carrying water a little too high.

Recalled.

By Mr. WHITE:

Q. What other engines of this size have you ever seen?
A. The Weimer Machine Co. engine.
Q. What is your judgment of the weight of this engine of this size, with 84-in. blowing cylinder?
A. Eighty tons.

By Mr. GUNTER:

Q. There is no difference in the weight of the engines of different sizes?
A. Yes; some little.

By Mr. WHITE:

Q. What other engines have you seen?
A. The McIntosh, Hemphill & Co.
Q. What is the weight of these engines of the same size?
A. I think their engines are 80 tons; it might be a half a ton more or less. I have also seen the Robinson, Rea & Co., and
256 I think their weight is a little less; probably seventy-five tons.
Q. What others?
A. Wm. Todd & Co. I think they weigh eighty tons; a very little difference from that. I bought one of the Columbus Machine Co. engines, with a guarantee that it weighed eighty tons, but I did not weigh it. It was my judgment that it weighed eighty tons.

By Mr. GUNTER:

Q. You never weighed any of these engines?
A. No, sir.
Q. How much does a cubic foot of iron weigh?
A. Four square inches weigh a pound.
Q. Does a square inch of iron weigh anything?
A. I do not know what you mean.
Q. Didn't you say four square inches weighed a pound?
A. That is my estimate.
Q. Then one square inch weighs one-quarter of a pound?
A. Yes, sir.
Q. Can you tell the weight of an engine by looking at it?
A. No, sir.
Q. How did you get their weight?
A. From the party who built them—in correspondence and in conversation with them.

Q. You say that the weight of the engine does not vary by the size of the steam cylinder?

A. I did not say.

Q. Will not the weight vary with the diameter of the steam cylinder?

A. Yes, sir.

Q. What is the weight of a 42-in. Weimer engine?

A. I cannot tell.

Q. How can you tell what a 36-in. weighs?

A. I give my estimate on an engine that would run from 36 to 42 in. steam cylinder and 84-in. blast cylinder would run 80 tons; it varies.

Q. What would a 42-in. weigh?

A. I cannot tell you.

Q. It would come up to 80 tons?

A. I never weighed a steam cylinder and I cannot tell what the weight is.

Q. What is the difference between the power of a 42-in.
257 and a 36-inch?

A. I cannot tell.

Q. It is considerably greater than a 36, is it not?

A. Yes; the steam power is.

Q. Don't the increase in weight have to bear some proportion to the relative increase in power?

A. I suppose there is a difference in manufactures.

Q. The greater the power in the steam cylinder is is not there a relative increase in the weight of the engine?

A. I think a larger steam cylinder would have more power and weight than a smaller one.

Q. You say the Weimer engine with a steam cylinder varying from 36 to 46 in. has a weight of 80 tons?

A. My best information is that the large one weighs 82 tons.

258 *Deposition of J. G. Chamberlain. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

(Copy.)

259 SATURDAY, *September 21st*, 1889.

J. G. CHAMBERLAIN recalled for respondents.

By Mr. TOMPKINS:

Q. You stated already that in no case was it possible to operate the three furnaces at Sheffield that you have charge of with the boiler and engine power that those engines have.

A. Yes, sir; I made that statement.

Q. Supposing it were possible by using all the engine and all the boiler power to operate these three furnaces and that in the operation of the three furnaces with that power the same proportion of coal would have to be used for three furnaces as has been used con-

tinuously for one furnace, what would be the cost per ton of iron for coal?

A. Fifty cents per ton or a little over; that is what it has been costing since I have been running the furnaces.

Q. I believe you stated that these furnaces were built for a daily average output of 125 tons each.

A. I believe I did.

Q. Then will you state what would be the loss in operating these furnaces if it could be done with the boiler power that is there by reason of having to use coal in the quantity that it is necessary to use under the boilers over what would be the cost of making the iron if the boiler power could be successfully operated by the gases from the furnace?

A. With the three furnaces in blast it would take from sixty to seventy thousand dollars per year, estimating that each furnace would yield 125 tons per day.

Q. Would it not, in your opinion, be a wise and economical thing for the company operating these three furnaces to take out the whole boiler power and the whole engine power and spend as much as one hundred thousand dollars for *a* new engines and
260 boilers if these furnaces were to be operated—all three together?

A. If by doing this they could operate these furnaces by the gas from the furnaces, I should say so, unqualifiedly.

Q. That is, from the gases, without having to use any quantity of coal?

A. Yes, sir.

Q. State whether or not, in your opinion, by rearranging the whole boiler and engine part of the plant such boilers and engines could be put in there as would enable the furnaces to be run with gases.

A. I believe they could, with this exception, that it always takes a little coal to keep the fires up, so as to ignite the gases.

Q. You heard the testimony yesterday of some witnesses about the escape of gas at the top of the smoke-stack. Will you state how these gases escape, and why, in your opinion, they escape in this furnace plant?

A. I have never noticed it escaping but a few times and burning at the — of the stacks, but the furnace will sometimes make more gas than at others, and it seems to run freely and makes more gas possibly by the tuyere leaking or cooler leaking, and the gas comes in the boilers in such abundance that it will not all be consumed under the boilers and will pass through and burn in the stack.

Q. It is only, then, when the furnace is doing exceptionally well, so far as the gas production goes, that the gases do escape from the top of the furnace; do I understand you to say that?

A. Sometimes we may have an abundance of gas when the furnace is not doing well, as far as the furnace is concerned, but making an abundance of gas that will pass through the *the* boilers.

Q. I mean that when the gas is passing out through the top of

the stacks that the furnace is doing exceptionally well, so far as the production of gas is concerned.

A. Yes, sir.

Q. Is it not always the case with a furnace that more or less gas is burnt at the top of the stack, as high as that?

A. Most all furnaces that I have had anything to do with burn gas occasionally at the top of the stacks and not necessarily because the stacks are high. I think more burn with low stacks than with high stacks.

261 Q. How high is this stack?

A. I could not tell you; in the neighborhood of 100 feet, I should think.

Cross-examination by Mr. GUNTER:

Q. What gases are the result of complete combustion of charcoal or coal?

A. Carbonic acid gas.

Q. If there was complete combustion in the furnace, what gases would escape that you could utilize further?

A. Carbonic oxide gas.

Q. You say that if there was complete combustion in the furnace that you would get carbonic oxide?

A. No, sir; carbonic acid.

Q. Then, if there was complete combustion in the furnace, what gases would you get that could be utilized further for combustion?

A. Carbonic oxide gas.

Q. If there was complete combustion, would there be any carbonic oxide escaping?

A. Yes, sir.

Q. Please explain how there would be.

A. On complete combustion you would produce carbonic acid gas; then it takes up another part of carbon (after carbonic acid gas is produced) in the furnace and makes carbonic oxide gas, but the combustion is complete to start with.

Q. It becomes incomplete to produce carbonic oxide?

A. After it has been made carbonic acid a portion of it changes to carbonic oxide.

Q. The purpose of a furnace is to have as complete combustion as possible, is it not?

A. Yes, sir.

Q. If all the coal or carbon which you put in the furnace is burnt complete and reduced to carbonic acid, would there be any carbonic oxide left?

A. There would be at the top of the furnace.

Q. The more complete the combustion throughout the furnace is, the less there would be of carbonic oxide and the more there would be of carbonic acid, would there not?

A. If, with complete combustion and perfect working of
262 the furnace, there is a limit to the amount of carbonic oxide gas and the amount of carbonic acid gas at the top of the furnace.

Q. I ask you if the proportion of carbonic oxide gas is not diminished just in proportion that the combustion is complete throughout the furnace.

A. There may be things to happen after the combustion is complete that will change these gases.

Q. Do you know the general character and proportion of the gases issuing from the top of the furnace?

A. If the furnace is working perfectly my recollection is about seventy of carbonic acid and thirty of carbonic oxide; in that neighborhood. I do not know the exact figures.

Q. How much nitrogen is there?

A. All there was that went in with the atmosphere.

Q. How much is that?

A. I don't know.

Q. When you speak of 70 parts of carbonic acid don't you mean 70 parts out of 100—70%?

A. I mean the relative proportion of the two gases.

Q. Do you know the percentage value of the fuel that is utilized in the way of heat in the best constructed furnaces and under the most favorable circumstances?

A. I suppose if it was working perfectly that all of it would be utilized in one way or another.

Q. I asked you if you knew about what percentage value of the fuel was utilized in a furnace conducted under the most favorable circumstances.

A. I answered that.

Q. You think it would be?

A. Yes, sir; if working perfectly.

Q. I mean a furnace conducted upon the best known plans and with the greatest skill with which furnaces are actually conducted.

A. Some would claim to work with great skill and get one result and some one else another. I cannot answer that question.

Q. With the greatest skill that you could bring to bear in operating a furnace, under the most favorable circumstances, what percentage of value do you think you could get out of the fuel in any shape for heating in the furnace?

A. I cannot tell you. I have not made any test of that for fifteen years.

263 Q. Did you ever make any test of it?

A. Yes, sir.

Q. What was the result of that test?

A. I do not remember; it was too long ago.

Q. Did you get as much as 75% in value?

A. No, sir; not in the value that I look at it. In my statement I said that if all things were perfect you would get about 70 of carbonic acid and 30 of oxide. When you do get that you get a perfect combustion and a perfect working of all materials in the furnace.

Q. Do you operate a furnace to produce waste gases at the top of the furnace to burn under the boilers and elsewhere or do you operate a furnace primarily to produce heat and combustion in the furnace for the purpose of reducing the ores?

A. We operate the furnace to make the largest output of iron and the best quality that can be produced from the smallest amount of fuel that can be used. That's what I would aim at. Then I would utilize the gases to the best advantage I could, whatever the result was.

Q. Then the less amount of fuel you have to use in the furnace to produce the largest and best quality of iron, with the most complete combustion in the furnace possible, the better the furnace operates and accomplishes the object in view?

A. Yes, sir; so far as the furnace itself is concerned.

Q. And the apparatus for burning the waste gases which come from the top of the furnace is a secondary matter—to save and utilize the gases which otherwise would escape and be lost?

A. Yes, sir; that is the case, but, of course, a good furnaceman would try to utilize these gases so as to get the most possible heat out of them.

Q. But you do not erect the furnace to get the best gases?

A. No, sir; that's not the primary object of it.

Q. You would not add fuel beyond what was necessary to make a complete reduction of the ores merely for the purpose of getting the waste gases?

A. No, sir.

264 Q. Then, the more complete the combustion is in the furnace—that is, the greater the amount of carbolic acid that is made to issue from the furnace by oxidation of the carbon—the more completely the operation of the furnace meets the ends in view?

A. That's my idea of it.

Q. You said just now that the furnace might not be operating well itself, so far as the furnace is concerned, and it might produce more gases than it would produce if it was operating well?

A. Yes, sir.

Q. Explain to the court how that could be.

A. Well, you might get some water in your furnace that would be decomposed and throw off a large amount of hydrogen; hydrogen combined with carbon makes an additional amount of gas.

Q. You think that the water added to the contents of the furnace would increase the burning capacity of the gases issuing from the furnace?

A. Yes, sir; with a small amount, or you could not get enough to destroy all the gases.

Q. You think the water would be decomposed going through and the hydrogen and oxygen separated?

A. Yes, sir.

Q. What would become of them; wouldn't they perform any function?

A. Possibly the hydrogen might; I do not know.

Q. You do not know what it would do?

A. I know it must get out of the furnace as a gas that would burn either by itself or in combination with carbon.

Q. Do you know that it would decompose?

A. Yes, sir; I do not think it is possible to hold it.

Q. It don't come out in the shape of steam?

A. No, sir.

Q. What degree of heat is it that disassociates oxygen and hydrogen forming water?

A. I don't know, sir.

Q. Do you know what heat is used in your furnace?

A. I suppose from 2,500 to 1,800 or 300 degrees; I do not remember exactly.

Q. What heat do you require to fuse the iron?

265 A. My impression is that the amount to melt iron is about 2,800 degrees, but I am not positive; that's my impression.

Q. Suppose your furnace was scaffolded and a large part of the contents of it were lodged and the scaffold should give way and come down into the more heated part of the furnace, would not there be more gas produced than usual?

A. There probably would, unless the scaffolding would fill up the furnace entirely; irregular working of the furnace often produces better gas, and scaffolding and slipping would be irregular working.

Q. An irregular working of the furnace from any impediment, then, that prevents full and uniform descent of the contents of the furnace to the hearth below, you think would produce more and better gas for burning in the boilers?

A. It produces better; sometimes more and sometimes less.

Q. What is scaffolding?

A. It is where some of the materials along on the inside of the inner walls of the furnace.

Q. Explain how irregular working, such as scaffolding, would produce more gas.

A. I don't know as I can explain just how it is done; I can give you my idea how, in some instances, it is done, if that is what you want.

Q. You stated as a fact that irregular working did produce more gases, and I want to know how it does or could.

A. I said it produced better gases for burning, sometimes more and sometimes less.

Q. How would it produce more or better gas?

A. The operations in the furnace would be imperfect and the carbons would not be doing well, and the consequence would be the production of more carbonic oxide.

Q. Then, the more perfect the operations in the furnace, other things being equal, the less gas is produced at the top of the furnace?

A. The poorer the gas for heating purposes.

Q. That's because the more perfect the operation in the furnace, the greater proportion of gases issuing from the furnace will be carbonic acid, instead of carbonic oxide?

A. Yes, sir; that's my view of it.

Q. Do you know the heating surface of the boilers you are using?

266 A. I never calculated it.

Q. You do not know, then?

A. Not from my own calculations; I do not.

Q. Have you had any analysis made of the gases issuing from your boilers and stoves?

A. No, sir.

Q. Have you had any scientific test made to determine whether or not your engines were using water carried over from the boilers?

A. I have not.

Q. Have you had any calculation made of the amount of water used for steam purposes for your furnace in a proportion to the amount of iron turned out?

A. No, sir.

Q. What quantity of flux do you use in your furnace per hundredweight of iron turned out?

A. We use from 1,100 to 1,300 pounds of limestone to a ton of iron, depending upon the quality of ore.

Q. Limestone contains a good deal of carbonic acid?

A. Yes, sir.

Q. Which goes out with the waste gases?

A. It goes out of the furnace some way; I do not know how.

J. G. CHAMBERLAIN.

267 *Testimony of J. G. Chamberlain, G. W. Killebrew, Alex. McIlwaine, Henry C. Brown.*

EXHIBIT "A," CHAMBERLAIN, KILLEBREW, MCILWAINE, BROWN. Filed in the clerk's office July 19th, 1890. A. W. McCullough, clerk.

(Copy.)

268 JACOB G. CHAMBERLAIN sworn for defendants.

By Judge TOMPKINS:

Q. What business are you engaged in now?

A. My present position is receiver of the Sheffield & Birmingham Coal, Iron & R'y Co.

Q. Have you any duties connected with the furnaces of the Sheffield & Birmingham Coal, Iron & R'y Co.?

A. Yes, sir; I have charge of the furnaces.

Q. Did you have any position connected with the company before the property was put in the hands of a receiver?

A. Yes, sir; I was general superintendent.

Q. When did you first assume any special charge and management of the furnace that is in blast at Sheffield?

A. Some time during the month of October, 1888, I think it was.

Q. What business have you been engaged in for the last twenty years?

A. I have been in the iron business.

Q. How long have you been connected with blast furnaces?

A. I built two in 1866 and in 1867 and was somewhat connected with some before that.

Q. Did you have charge of both their construction and operation?

A. Yes, sir.

Q. Have you been in a position to make an intimate personal examination of these furnaces at Sheffield?

A. Yes, sir; I think so.

By Mr. WHITE:

Q. Was there a system of valves from the boilers to the engines of this plant?

(Intervenors object to this question for the reason that it calls for illegal and irrelevant evidence. Second. Because it is not shown that the valves spoken of were stipulated in contract and form no part of the specifications for the work. Third. That the contract itself provides for the reference of all such matters to the decision of the superintendent of defendant, and that his acceptance and decision should be final, and it is shown that the work was finally accepted by such superintendent, and it is not averred or alleged that there was any fraud or collusion or other legal cause for attacking the decision of such superintendent. Ruling of the master reserved.)

269 A. There were no valves between the engines and the boiler; there was one valve at each of the boilers and one at each of the engines.

Q. Then you say that there was no system of valves?

A. Yes, sir.

Q. Explain what constitutes a system of valves between the boilers and engines.

(Same objection.)

A. There was a 12-in. pipe running the entire length of the battery boilers across the boilers on top to which each of the boilers is connected. From that main pipe there are three branches the same size running into the engine-house. On the inside of the engine-house there is another pipe the same size running parallel with that and nearly the entire length of the engine-house. From that pipe there was a pipe reaching to the different blast engines, and from that pipe there was a pipe reaching to the pump-house. In this line of pipe and these three branches there were no valves. A system of valves should be put in at such place on these pipes so that any battery of boilers could be shut off while the others were running and so that any pipes could be repaired while the other parts were in use.

Q. What was the effect of the failure to have that system of valves?

(Same objection.)

A. The effect was this: that if any of these joints gave out, which

every one of them did, I think, without an exception, we were obliged to stop the furnace or furnaces until they were repaired. In doing that the only supply of water that we had was in two tanks and that supply, if all three furnaces were in blast, would hardly last long enough to make or repair more than, perhaps, one joint, if that much, as the pumps could not be run while repairs were being made.

Q. A system of valves, then, would have obviated that difficulty?

A. Yes, sir.

Q. How?

A. You could then shut off one set of boilers from this pipe and then go ahead with the other boilers and fix it. I would say, in connection with that question, that pumps were attached to the inside pipe, twelve-inch pipe, which was a defect. It should have been directly connected with boilers; steam could then be shut off all these twelve-inch pipes and you could still run your pumps.

Q. Is a plant of the character of the one in question ade-
270 quate in design and workmanship which fails to provide a system of valves between the engines and boilers?

(Same objection.)

A. No, sir.

Q. What would be a reasonable cost of placing that furnace perfect in that respect, as to a system of valves?

(Same objection.)

A. I suppose $1,200 to $1,500.

Q. Was there an independent steam pipe from the boilers to the pumps?

(Same objection.)

A. Not from the boilers.

Q. Was such a pipe necessary, looking at the original construction of the furnaces as they were?

A. Yes, sir.

Q. It was necessary whether or not there had been any valves?

A. Yes, sir.

Q. Why was that necessary?

(Same objection.)

A. When any of the 12-in. steam pipes was shut off from the boilers by this independent connection with the boilers to the pumps we could keep up the supply of water for the furnaces.

Q. What would be a reasonable cost for putting such a pipe in?

(Same objection.)

A. From $150 to $200.

Q. Were the furnaces stopped during the time you put them in?

A. Yes, sir.

Q. Was such stoppage necessary in order to do the work?

A. Yes, sir.

Q. What was the cost, lookong at the whole matter?

(Objection on the further ground that it calls for remote and speculative damages.)

A. It is very difficult to answer that question; it would take considerable figuring. I cannot answer it off-hand.

Q. Was there any valves in the main water-supply pipe that fed the pumps with which to shut the water off from the pumps?

(Same objection.)

A. There were valves at the reservoir, but none anywhere else.

Q. Was such valve necessary?

A. Yes, sir.

(Same objection.)

Q. Why was it necessary?

271 A. Should any of the valves give out at the pumps there was no way of shutting off the water so that you could repair that valve or put a new one in, except that you would let the whole pressure of water go down into the engine-house.

Q. Was it probable that these valves would give out?

A. I found one when I took charge of the furnace that had to be repaired.

Q. What would be a reasonable cost of putting this valve in that you speak of?

(Same objection.)

A. $12 to $15. A little more than that—from $15 to $25—when furnaces were being built.

By Mr. COOPER:

Q. In event that there was no intermediate valve and a valve which fed the pumps was broken would that require the furnaces to shut down for repairs?

A. Not necessarily with one valve, but should any part of that main pipe give way it would be necessary to stop the furnace.

Q. How long would it take to repair in that contingency?

(Same objection.)

A. It might take several days. There should have been an extra pipe reaching from pumps and tanks to where the standard comes up from the ground, near No. 1 furnace, so that should any part of main pipe give away any part could be repaired.

Q. What would that pipe have cost in the original construction of the furnace?

A. $150 to $200.

Q. What is the capacity of that stock-house as measured by the furnace?

(Same objection.)

A. I think it is just about large enough for two furnaces of the capacity of these furnaces.

Q. What additions would have to be made for it for the three furnaces?

A. I think 150 feet at each end and about 30 feet wider.

Q. That would involve an expenditure of how much, reasonably?

A. I expect $4,000; possibly more.

(Same objection.)

Q. What do you base your opinion on as to the capacity of that house—actual test or theory?

A. From the room that we had to occupy to run one furnace conveniently.

Q. What part of a plant is a stove?

A. That portion of the plant where the air is heated.

Q. How many sets of stoves at each furnace?

A. Three.

272 Q. Are the outlet pipes that lead from the furnace to the stove connected and supplied with a system of valves?

A. No, sir.

Q. Was that a defect in design and workmanship?

(Same objection.)

A. In my opinion, it is.

Q. Why was it?

A. If they were connected you could interchange any one hot blast with any one furnace, or all.

Q. Does that ever become necessary?

A. Yes, sir.

Q. Why or how?

A. The brick and iron might break and you could then keep up a full heat by using another set of stoves.

Q. What would be the reasonable cost of making such connection?

A. I do not think I can answer that question; $1,500 to $2,000.

Q. Are these furnaces and stoves connected by a set of bridges or simply connected with each hoisting tower and one particular furnace?

A. With each hoisting tower and one particular furnace.

Q. In your opinion is it necessary to have a bridge connecting these each with the other?

(Same objection.)

A. Yes, sir.

Q. Is a plant which fails to connect these with bridges adequate in design and workmanship?

A. Not in my view.

Q. Why is such a plant as that defective in that respect?

A. If anything should happen to the hoisting engine or hoisting tower of one furnace so that you could not raise stock you could keep the furnace going by taking stock up one of the other hoists; otherwise you would have to stop.

Q. Does it ever happen that the hoisting machinery gets out of fix?

A. Yes, sir; ours once stopped twenty-four hours, as near as I can remember.

Q. What would be the reasonable cost of connecting these furnaces by a set of bridges?

(Same objection.)

A. Well, I would say, from a rough estimate, $4,000 for the two bridges.

Q. What is a battery of boilers? How many does it consist of?

A. It may be two, three, or four.

Q. What are they at that plant?

A. Two boilers.

Q. That plant has six batteries of two boilers each?

A. Yes, sir.

273 Q. The purpose of construction was to operate three furnaces, was it?

A. Yes, sir.

Q. What's a boiler for?

A. For making steam.

Q. Are these batteries of two boilers each sufficient to operate the three furnaces?

(Same objection.)

A. No, sir.

Q. Why are they insufficient?

A. Because it takes all the steam that we get with one-half of these to run one furnace.

Q. Then your answer is based upon an actual trial?

A. Yes, sir; for nearly a year.

Q. What trial have you given?

A. Nearly every one that I could conceive of.

Q. How many boilers did it take to run that furnace?

A. We are not able to do it with three batteries without a great deal of difficulty.

Q. What was the result of the trial with two batteries?

A. We could not get steam enough to run the engine as it should be.

Q. What do you mean by as it should be?

A. We could not make iron up to capacity of furnace.

Q. What would be the capacity of a furnace of that kind operated by three batteries?

A. One hundred and twenty-five tons per day.

(Same objection.)

Q. What is the capacity of one furnace run with two batteries?

A. I do not think much of anything for any great length of time.

Q. Would it produce any practical effect in making iron?

A. Iron could be made, but I think in a short time the furnace would have to be blown out.

Q. Was iron being made with one furnace and two batteries at a profit or loss?

(Same objection.)

A. I think it would be at a serious loss. I would like to make an explanation here. You might have boilers of sufficient capacity and the engine be such that you could not blow it successfully.

By Mr. COOPER:

Q. According to the construction of these furnaces, is the boiler sufficient to run all three of these furnaces at the same time?

274 A. No, sir; with the boiler power and engines you could not run the three furnaces at once.

By Mr. WHITE:

Q. With the boiler power of the construction of these furnaces how many furnaces could you run?

A. I think I could run two.

Q. Then an actual test has demonstrated that with those boilers and engines combined you cannot run one furnace with two batteries?

A. Yes, sir.

Q. You cannot determine whether the defect is in the boilers or in the engines?

A. No, sir; I do not want to settle that point.

Q. The boilers and engines both have to be used to make iron?

A. Yes, sir.

Q. Then these boilers and engines are not sufficient to run three furnaces?

A. No, sir.

Q. What do they lack?

A. I think there should be three more batteries of boilers.

Q. What would be the reasonable cost of three more batteries of boilers constructed there?

(Same objection.)

A. From knowledge that I have derived it would cost from $20,000 to $22,500 for three additional batteries.

Q. How many blast engines in that plant?

A. Seven.

Q. How many boilers?

A. Six batteries of two boilers each.

Q. What is the idea of having one more engines than the number of batteries? Is it the general custom to have an extra engine?

A. There should be.

Q. Why?

A. If all three furnaces are in blast it is intended that two engines

should run one furnace, and if one engine should give out we should have one to run while the other is being repaired.

Q. Is an engine out of repair a very common thing?

A. Yes, sir.

Q. How do you measure an engine as to its strength? Were these heavy or light engines?

A. They are light engines as to weight.

Q. To what speed can you run these engines with practical safety—how many revolutions per minute?

275 A. Thirty-five to thirty-eight; forty at the outside.

Q. In your opinion, are these engines adequate in design, strength, capacity, and workmanship for the purposes for which they were intended, namely, the operations of these three furnaces?

(Same objection.)

A. I do not think they are.

Q. State your reasons.

A. I have to run three of these engines to get blast enough to run one furnace; practically that is one reason. I do not consider it safe to run two fast enough to get blast enough to run one furnace.

Q. In your opinion, is — safe to run them faster?

A. It is not safe to run two fast enough to run one furnace.

Q. Why?

A. Because I think they would break down and give way; I think the engines are too light in weight for that work.

Q. Has a practical test developed any defect?

A. Yes, sir.

Q. State what it is.

A. Two of the bed plates have broken through in the middle.

Q. What are bed plates?

A. They are cast-iron plates on the foundation.

Q. Two of them are broken?

A. Yes, sir.

Q. How were they broken?

A. Right through the middle. One is broken on one side and partly on the other; the other is broken clear through the whole frame.

Q. With what degree of care have you operated these furnace-; have you had efficient man?

A. Yes, sir; I think I have had a little better men than are usually employed for that purpose.

Q. Are your employees reliable and competent men?

A. I consider them so.

Q. Have you operated that furnace recklessly or carefully?

A. I think it has been operated with care and intelligence.

Q. What's the damage to those two engines where the bed plates are broken?

(Same objection.)

A. I do not think it could be repaired for less than $1,000 to each engine, and do not think it could be done for that.

276 Q. Did engine bed plate break by reason of the engine being too light?

A. I think it happened because of the bed plate being too light and not having sufficient holding bolts.

Q. What are holding bolts?

A. They hold the bed plate down to the foundations.

Q. How many were there?

A. Four; one at each corner.

Q. How many bolts should there be?

A. I think there should be eight instead of four.

Q. How many engines of the kind and character of these engines would be necessary to run three furnaces if the boiler power were sufficient?

A. I think not less than eight; one more engine. It would then be a little short.

Q. What would it cost to put in another engine?

(Same objection.)

A. I think in the neighborhood of $10,000.

Q. Have the engines ever shown any defect in any other respect?

A. Yes, sir.

Q. What was it?

A. One of the piston heads of the blast cylinder is broken.

Q. Why did it break?

A. I think because of defective construction in the casting.

Q. Was the engine being used when it was broken?

A. I suppose it was. We found it broken. The casting seemed defective.

Q. How were these furnaces banded, sufficiently or insufficiently?

(Same objection.)

A. I think there was one defect in the band made above tuyere arches, and I think it needed a stronger band below the tuyere arches.

Q. Did that furnace exhibit any defect in that respect?

A. The band that is below the tuyeres has broken and the brick-work above the tuyeres has expanded out about three or four inches.

Q. Has repairs been necessary in that respect?

A. I found it very difficult to make repairs. The best I could do was to put a brace on the column against the plate. I could not get a band on well.

277 Q. What would have been the cost to band it, to begin with?

A. I suppose $50.

Q. What would be the cost of doing it now?

A. I have some doubt as to whether it could be done now, as we would have to shut the water off to do it.

Q. If could be done, could it not?

A. Yes; by taking the water off from furnace.

Q. How much would it cost to do it now?

A. I think we would have to stop the furnace a day or two, and

it is very hard to say what the cost would be; somewhere from $200 to $500.

Q. What are coping stones to the foundations of cast-house?

A. A stone that is put on the top of the wall before you commence the brick-work.

Q. What kind of coping stones did they use in the construction of these casting-houses?

A. Strictly speaking, there was no coping stone used; the wall was built with some large and some small stone up to the brick-work.

Q. Then the casting-houses had no coping stones?

A. No, sir.

Q. What would it have cost to have put coping stone in the casting-houses?

A. About $200, as a rough estimate.

Q. What defect has the use of the house developed in that respect?

A. The walls are giving away.

Q. What has been necessary to be done in order to remedy this?

A. I have made cast-iron plates for number one and number two furnace.

Q. Is the casting-house, in your opinion, Mr. Chamberlain, of adequate design and workmanship—that is, put up in a manner in which that one was erected?

(Same objection.)

A. It is defective in workmanship and possibly in design.

By Judge TOMPKINS:

Q. What quantity of coal is it necessary to use under the boilers in order to make steam to run one of the furnaces?

(Same objection.)

278 A. I think the amount we use is not less than five hundred pounds to each ton of iron; I think it has taken rather over than under 500 lbs. to each ton of iron made.

Q. Then what part of the cost of the iron is that?

A. About fifty cents per ton.

Q. State how steam is generated in the boilers by the application of gases that arise in iron-making.

A. The escaping gases from the top of the furnace are brought down in pipes and carried in flues in this case-brick, I believe, and carried to the boilers, and it is generally calculated that these waste gases will produce fuel enough to make steam enough to run the furnace. It takes a little coal from time to time to keep the gases ignited as they come in.

Q. Do you know anything about the Lady Ensley furnace that is now in operation at Sheffield?

A. I have seen it.

Q. Do you know anything about what quantity of coal is used at that furnace under the boilers?

A. I do not know only from what I have heard.

Q. Haven't you any idea from your general knowledge of furnace operations as to what should be the quantity of coal used in value, per ton of iron made, in a properly constructed furnace where the gases of the furnace are sufficient with which to operate the boilers?

A. I think that if the boilers and engines are all right it ought not to take but one hundred pounds, and even less than that.

Q. If it took, say, one hundred pounds of coal to each ton of iron at the furnace you are operating, at the price you pay for coal, what would that be per ton of iron made?

A. I suppose from 10 to 12 cents.

Q. As it is, I understand you to say that it is about fifty cents per ton?

A. Yes, sir.

Q. Does not this necessity of using this quantity of coal to make steam involve a large amount of labor outside of the mere price of the coal itself?

A. Yes, sir.

Q. Do I understand you to say that the necessity for using this large amount of coal to make iron at this furnace arises from
279 the faulty construction and inadequacy of the boiler power and the engines?

A. Yes, sir; I think it does.

Q. What average amount of iron have you made at that furnace and are now making?

A. I think about 110 tons per day on an average. This includes the time that we have been stopped in making repairs.

By Mr. WHITE:

Q. I understand that one furnace is operated by three batteries of boilers and three furnaces?

A. Yes, sir. We may, for a short time, have run only two engines, but three for a large majority of the time.

Adjourned for the day.

280 THURSDAY MORNING, *September 12th*, 1889.

Reconvened at 10 a. m.

Mr. CHAMBERLAIN on the stand.

By Mr. TOMPKINS:

Q. Do you know how long furnace "A" or number one was in blast?

A. I was not in Sheffield during the time, but to my best recollection it was from eight to ten days.

Q. Do you know how much iron was made at that furnace during the time it was in blast?

(Same objection.)

A. I think our books show 106 tons.

Q. Do you know who had charge of that furnace during that time?

A. Between Mr. Gordon and Mr. Doud; I am hardly able to say which one.

Q. That was the first furnace that was blown in of the three of the Sheffield & Birmingham Coal, Iron & R'y Co.?

A. Yes, sir.

Q. Do you know the time it was blown in?

A. No, sir; not exactly; think it was the 17th August, 1888.

Q. Did you see that furnace after it was abandoned—after it had run those eight or ten days?

A. Yes, sir.

Q. What was its condition?

(Same objection.)

A. The hearth and a portion of the bosh was entirely destroyed, so as to be of no value.

Q. What is the condition of that furnace now?

A. It has been repaired and is ready to be blown in.

Q. Under whose supervision was it repaired?

A. It was started by Mr. Doud, but I finished it up.

Q. What did it cost to repair it?

(Same objection.)

A. From the figures which I have taken from the books of the company, $6,726.58.

Q. Does that include your salary?

A. No, sir.

Q. What did it cost to make the 106 tons of iron that was made in those nine days by furnace "A"?

(Same objection.)

A. I think about $60 per ton. I have not the figures with me.

281 Q. What, in your opinion, ought it to have cost to have made those 106 tons?

A. Perhaps, when furnace was blown in just for a few days, $15 per ton.

Q. Have you made any estimate as to the damages or loss occasioned to the company by the unfortunate blowing in of furnace "A" and ruining it as it was done?

(Same objection.)

A. I have made an estimate of what it cost, considering material, repairs, and labor altogether. I have not made an estimate of what the damage may have been by stoppage; not counting the $549.90 in connection with the boilers and pipe repair, $11,002.93.

By Mr. BRICKELL:

Q. Does that include the $6,726.58?

A. Yes, sir.

By Mr. TOMPKINS:

Q. As an expert and as a furnaceman, looking at all the facts and circumstances connected with the blowing in and ruining of that first furnace of the Sheffield & Birmingham Coal, Iron & Railway Company, what do you think is a fair estimate of the loss and damage to the company, outside of the items you have already mentioned, by reason of the ruining of that furnace and the failure of the company to start in making iron under favorable circumstances?

(Same objection, and the further objection that it calls for remote and speculative damages.)

A. Should I include in that the effect it might financially have upon the company?

Q. Everything in the matter of damages and loss.

A. It was far-reaching in its effects, and I suppose the company might have been $50,000 to $100,000 better off to-day if that trouble never had happened.

(Same objection.)

Q. What Mr. Gordon was it that was in charge of that furnace "A"?

A. Mr. Frederick W. Gordon, in connection with Mr. E. Doud.

Q. Of the firm of Gordon, Strobel & Laureau, the complainants in this case?

A. Yes, sir.

Q. Do you know who proceeded to blow in No. two furnace?

A. No, sir; I was not there. I only know from general information.

Q. Who were then?

A. Mr. Doud and Mr. Gordon had charge at that time.

Q. Do you know how much iron was made?

282 A. The books turned over to us by Mr. Doud show that there were 2,472 tons of iron made from Sept. 1st to Oct. 20 by furnace No. 2. The actual amount made was about 2,000 tons.

Q. What was the cost of that iron?

A. As shown by the books turned over to us by Mr. Doud, $20 per ton.

By Mr. BRICKELL:

Q. Have you any knowledge of it?

A. I only know it from the books that were turned over to me by the former management.

By Mr. WHITE:

Q. Did not the information come from Mr. Gordon?

A. I succeeded to all reports from Mr. Doud.

By Mr. BRICKELL:

Q. Where are those reports?

A. In the office in Sheffield.

Q. When did you take charge of furnace "B"?
A. I think the 20th of October, 1888.

Mr. BRICKELL: You stated on yesterday that it was 22d October, and now you say the 20th.

By Mr. TOMPKINS:

Q. Your recollection is that it was the 20th October?
A. About that.
Q. Who had been in immediate charge before you took charge?
A. Mr. Edward Doud.
Q. What was the condition of the furnace when you took charge of it?

(Same objection.)

A. The furnace was badly filled upon the bottom and hanging on the sides.
Q. How often was it necessary to cast at the time you took charge of the furnace?
A. Sometimes every hour and sometimes every two hours.
Q. How often is it necessary to cast now?
A. We cast every five hours. The furnace is very weak and thin on the sides, and I do not think best to hold it longer than five hours.
Q. If everything were all right would it be necessary to cast less than every six hours?
A. No, sir.
283 Q. But if the furnace is weak you have to cast oftener?
A. Yes, sir; I have fears that the iron would break out if held longer.
Q. How long was it after you took charge of that furnace before you were able to bring it around so as to make your casting only every five hours?
A. I think between four and five weeks.
Q. During that time was the output of iron greater or less than it would have been if the furnace had been in good condition?
A. It was less.
Q. Does or does not the running of a furnace when you are making less iron than its capacity always cause a running at a much larger expense than if you were running its full capacity?

(Same objection.)

A. The expense is always greater.
Q. Why is it greater?
A. You have to keep the same amount of labor and pay for it with an increased cost on a smaller output.

(Same objection.)

Q. Now, Mr. Chamberlain, have you made an estimate—if not, make it and answer it—as to the loss the company sustained during the time that those two furnaces, one now in operation, had to be brought so that it could make the quantity of iron that it is now making.

(Same objection.)

A. I have made no figures on that and would like to have a little time. I could only give a rough estimate of it. My recollection during that time is that the iron cost $20 per ton. It would have cost less than $12 if the furnace had been running regularly, and I think that the iron made during that time was from 2,000 to 2,500 tons, and the loss then would be about $16,000. That does not include my salary.

Q. I want you now to state, in your own way, whatever you desire to state going to show the faulty and inadequate construction of this furnace plant in any part that you are aware of by reason of having operated it and found out the defects by actual experience. You can refresh your memory from any notes that you may have, but you must make your statements of your own knowledge.

(Same objection.)

284 A. In addition to what I stated yesterday, in regard to the steam pipe to the hoists, I would say that this pipe was connected into the general system of pipes, in which there were no valves. It should have been connected directly with the boilers, so that in case repairs or anything had to be done to the large steam pipes that the one running to hoist could get steam from any one. I have in part remedied that defect by making a connection with three batteries of boilers. The steam pipe to the pumps in the pump-house near the reservoir was connected in this same system of pipes. It should have been connected directly with all the boilers, so that the steam from any one of the boilers could be used by any one of these pumps or all of them. I have in part remedied that by connecting them with three batteries of these boilers. The steam pipe at the river was connected with the boilers direct for the same reason that I have given for the others, and I have partially remedied that defect by connecting them with three batteries of boilers. We found some defects in the engines that I did not mention yesterday. We found the steam-packing ring in the steam cylinder poor in construction on account of inferior Babbitt metal which was used in them, allowing the steam to leak through, and consequently a loss of power. We have remedied this, in part, by getting new and different rings, and in part by putting in better Babbitt metal in the same rings we have. We have also found some defects in the blowing cylinders. The springs were not adequate to hold the packing tight to the blowing cylinders. The screws in the springs that set out the packing were very much too small, and we are replacing them as fast as we can with larger ones. We found the air valves in which the air passed in and out of the blast cylinder faulty in construction. The castings in which they were set were so small the shrinking of the valves let the air pass through them and lost a large amount of blast. We have remedied them as fast as we can by changing and enlarging the casting so as to allow more shrinking of valves and still hold the air. We have found the steam cylinder in the piston

heads carelessness in putting together, perhaps, more than from faulty construction, and the bolts that hold the follower and the packing in the steam cylinder, when put in place, should have been held
285 by something behind them, so that they could not get loose. We found nothing in these engines to hold these bolts in their places, which could have very easily been done by placing small pieces of wood behind them. In one instance one of the bolts fell out in the cylinder, and the damage will cost not less than $500 to repair. We are remedying these defects as fast as we can, properly protecting these places, and keeping the furnace in blast. I think there is a very serious defect in the size of the holding bolts that hold the bed plates to the foundation. I stated yesterday that there was not enough of them. I will state in addition to that that they are not large enough. They should have not been less than 2½ in.; they are only 2 in., and it takes great and constant care to keep the bolts tight holding down the bed plate. In general, I think the engines are too light and will not stand the work which it was intended for them to do. Again, I think the engines should all have been connected with all the blast pipes leading to the stoves. There are three pipes, and each engine should have been connected with these three pipes, with valves to shut off any portion you wished, so that you could use one engine or all the engines on one furnace directly from these pipes. That would necessitate three connections with the blast pipes and the engines with proper valves instead of two, as there now are. I found also some very careless work done in the brick-work. Where we have taken out the cooling plates there are several instances were brick should have been put in; a space equal to three or four brick was left entirely hollow.

Q. State where that was.

A. In the bosh of the furnace; more especially of number three. I think there was also a defect in regard to the stoves, in carelessness of workmanship or something of that kind. We found a portion of the walls in one instance to give away, and I think there should have been covering on top of the brick-work, at the top of these stoves, between the top of the brick-work and the shell; it should have been filled up with some substance which was a non-conductor of heat, which was left undone, and which we have since done on two furnaces. This or some other fault has caused some trouble, and we will probably have to stop and
286 let the stove cool off and repair it. In doing this it very seriously interferes with the working of our furnace. We have also found some defect in the foundation in the different batteries of boilers, in the centre of which holds up a beam which holds up the boilers. All of these have settled more or less, and the beams are not strong enough of themselves to hold the boilers, and on account of the settling it has given us considerable trouble in breaking the iron plates connecting the two boilers. I would not swear absolutely that that was the cause of it, but cannot account for it in any other way. In general, I would object to the whole system of that kind of boilers for blast-furnace work. I think it would be money in the company's pocket to give them away to somebody and build differ-

ent kind of boilers; that has been my experience. I would say further that I have, so far as I can, remedied all these defects, and the results is I am getting more satisfaction in the working of the furnace—that is, more particularly the defects in regard to the water pipes, steam pipes, and valves. I have done all I could do as fast as I could do it in trying to remedy the defects in the engines, but I could not do that so far as making them stronger.

(Same objection.)

Q. What have you done, as far as you could, about remedying the defects in the boiler power?

(Same objection.)

A. I have done everything I could conceive of doing. I have had plates put in, I have had the bridge walls put up higher, and have had them taken down lower. I have done everything that has been suggested by the manufactures.

Q. What manufactures?

(Same objection.)

A. Babcock & Wilcox.

Q. Have you caused any expert from the manufactory to come and look at these boilers?

(Same objection to the substance, but not to the form of the question.)

A. I have requested them, Babcock & Wilcox, to send their man, which they have done in two instances. One time he stayed two weeks with us. I have done everything that he suggested. I found that the engines were pumping over a very large amount of water from the boilers, causing a great deal of trouble, and I wrote Babcock & Wilcox, asking for some suggestion from them, and they sent their man.

287 Q. Then what did you do?

A. I ordered dry pipes from Babcock & Wilcox and put them in all the boilers.

Q. Have you or not already given an estimate of these changes that you are now speaking about?

(Same objection.)

A. There was no cost in regard to these dry pipes except our labor.

Q. Have you already given in your testimony the general items of cost of changes you have made about the furnaces?

A. I think I did, in part, yesterday. All of it I cannot give, because I have not yet any bills for the last work that has been completed in the last few days in connection with the boilers and steam pipes.

Q. The petitioners in this case admit that they have been paid $514,500 for the construction of this furnace plant. State whether or not, in your opinion, that is all that the furnace plant is worth.

(Same objection.)

A. That is all I would give for it.

Q. Would you give that much?

A. No, sir.

Q. Now state what the furnace plant, as it existed at the time the first furnace was blown in, was, in your opinion, worth.

(Same objection.)

A. In my opinion, it was not worth over $500,000.

Cross-examination by Mr. GUNTER:

Q. What is your business as a profession?

A. I have been connected for 22 or 23 years in building and operating blast furnaces and rolling mills.

Q. You were a civil engineer by profession, were you not?

A. That was my profession in my younger days.

Q. Were you a mechanical engineer?

A. No, sir; I did not profess to be.

Q. How were you connected with any other furnaces and in what way?

A. Had charge of building and running them.

Q. Did you contract to build them?

A. I was superintendent and part owner.

Q. Did you make the specifications and details?

A. Yes, sir.

Q. How many furnaces did you superintend the construction of?

288 A. Three; the first two at Leetonia, Ohio; one at Moxehala, Ohio, and made plans and specifications for another furnace.

Q. You drew all the plans and details for these?

A. Yes, sir.

Q. How far apart were they?

A. Seventy-five feet, possibly.

Q. Did you have a bridge between them?

A. Yes, sir.

Q. How many hoists did you have?

A. One hoist between them and bridges from that hoist to each furnace.

Q. When was that?

A. In 1866 or 1867.

Q. You could not get up to the top of your furnace from your hoist in that case without a bridge from the end of the hoist to the top of the furnace, could you?

A. No, sir.

Q. You have seen a great many furnaces, have you not—modern ones?

A. Yes, sir; I have seen a great many.

Q. How many did you ever see as far apart as yours with a bridge between the hoist of each?

A. I could not say.

Q. Did you ever see any?

A. Yes, sir; the De Bardeleben furnaces, I think, but I do not know how far apart they are.

Q. You have seen a great many furnaces?

A. Yes, sir.

Q. In operating furnaces it is intended and expected generally that the heating is to be done by gases and the stoves and boilers are to be heated by gases, are they not? That's the purpose, isn't it?

A. That's what we aim at.

Q. Where do these gases come from?

A. From the top of the furnace.

Q. The gas comes from the top of the furnace and is conducted under the boilers and in the stoves?

A. Yes, sir.

Q. And the boiler produces the steam that runs the engine that pumps the air into the stoves and from the stoves into the furnace?

A. Yes, sir.

Q. Now tell me, does not the heating power applied to the boilers result from the quantity and quality of the gases, or both?

A. From both.

Q. You say you have to apply coal under the boilers about 500 lbs. to the ton of iron?

A. Yes, sir.

Q. You say that the heating power depends, irrespective of the coal, upon the quantity and quality of the gases. Now,
289 explain to me how the quantity and quality of the gases is effected in any way by this machinery—how it is determined in the gases of the furnaces?

A. If you would blow the furnace hard enough to make a certain amount of iron in 24 hours you would get more gases in that 24 hours than you would if you blew only half of such air into the furnace.

Q. If you blew twice as hard and consumed more fuel you would get more gas?

A. Yes, sir.

Q. Would you have to do more work to get more gas?

A. Yes, sir.

Q. How would that increase the quantity and quality of the gases in reference to a given quantity of work it would have to do?

A. I did not say that it would effect the quantity and quality of the gases.

Q. It would increase the quantity of iron, would it?

A. No, sir.

Q. Suppose there was a deficiency in the heating power, how does the machinery have anything to do with the quantity and quality of the gases per ton of iron produced?

A. The action of the machinery is dependent upon the amount

of steam you make, and the amount of steam you make depends upon the amount of heat you get from the fuel.

Q. How do you remedy the defect in the quantity and quality of the gases? Where is that to be increased by the machinery, per ton of iron produced?

A. You can only get so much gas from a ton of iron.

Q. Did you get the gases from the iron?

A. Yes, sir; in part from the iron ores.

Q. What do you put the blast in a furnace for?

A. To produce heat to produce gases.

Q. How are the gases made?

A. Largely from combustion of the fuel.

Q. The iron is not fuel, is it?

A. A part of the gases is made from the oxygen in the iron ore.

Q. Does oxygen exist in the iron ore?

A. Yes, sir.

Q. Do you know the difference between carbonic oxide and carbonic acid?

A. Carbonic oxide is one part oxygen and one part carbon
290 gas, and carbonic acid gas is one part of carbon and two of oxygen.

Q. State, in the gases that come from the top of the furnace, what gases do they consist of.

A. Carbonic oxide, carbonic acid gas, nitrogen, and moisture or steam.

Q. Where does the moisture come from?

A. From the atmosphere, and a part from the materials from the top of the furnace—ore, coke, and limestone.

Q. What material furnishes most of it?

A. It depends upon circumstances.

Q. What part of the materials?

A. It depends upon whether or not the ore, coke, and limestone have been exposed to the weather. The ore and coke will absorb more moisture than the lime.

Q. How is the coke brought to the furnaces?

A. In cars.

Q. In open cars?

A. Yes, sir.

Q. Does more or less moisture being in the materials affect the gases?

A. Yes, sir; I suppose it may.

Q. What shape does it get out in?

A. Vapor.

Q. Vapor or steam highly heated?

A. Yes, sir.

Q. Necessarily vapor or steam?

A. Yes, sir.

Q. If a gas has moisture in it does the moisture or vapor affect its burning quality?

A. I presume it may, but do not know to what extent.

Q. What is the composition of lime as you use it?

A. Carbonate of lime.
Q. What effect does heat have upon that?
A. It separates the carbonic acid from the limestone.
Q. In what other way would it escape?
A. It might, to a certain extent, combine with something else.
Q. With what could it combine?
A. It could combine and take up more carbon.
Q. You do not know what it does?
291 A. I cannot tell exactly what takes place in a blast furnace.
Q. Do you have to get in one to tell what is going on?
A. I suppose you do; I was never in one.
Q. Scientific men undertake to tell the composition and action of things out of their sight?
A. Yes; and they do not always agree.
Q. What would you say to an undue quantity of carbonic acid gas intermixed with gases coming to the top of the furnace—what would be the effect of the heating quality of the gases?
A. The more carbonic acid gases the less heat.
Q. Carbonic acid gas is increased by putting in limestone beyond a certain amount, isn't it?
A. If you put in more than was needed you might not get any gases at all in a short time.
Q. The quantity of gas is enlarged by the quantity of lime, is it not?
A. If you put in too much you would likely not get any gas in a short time, as stated before.
Q. Would an excess of limestone decrease the gases?
A. Then I would say you would not get any gases by a large excess of limestone.
Q. Suppose you put in a pound too much—would that stop the furnace?
A. No, sir.
Q. Then it would decrease the quantity of gases, would it not?
A. I am not sure that it would.
Q. Would 100 pounds do it?
A. I do not think it would have any effect upon it.
Q. If gases are intermixed to a large extent with carbonic acid gas it decreases its heating capacity, does it not?
A. Yes, sir.
Q. Then too much lime decreases the gas itself, does it not?
A. No, sir; I cannot subscribe to that.
Q. You admit that limestone contains carbonic acid gas?
A. Yes, sir.
Q. And that carbonic acid gas deteriorates the burning capacity?
A. Yes, sir.
Q. State how.
A. Because it has not the heating properties.
Q. Then too much lime does effect the gas?
A. Yes, sir; it may.

292 Q. You say your coke is exposed to the weather as it is brought there?

A. Yes, sir.

Q. Where is the coke manufactured that you use?

A. At Jasper, Ala.

Q. Do you know of any other furnaces that use the coke?

A. No, sir; none at present.

Q. Have you got an analysis of that coke?

A. I have had several made.

Q. Suppose there is sulphur in the materials you put in your furnace, in combination with other materials you put in, please state what effect that would have upon the operation of the furnace. Suppose you had materials without sulphur and other with 20 %, would that make any change in the charge of the furnace; and, if so, what?

A. If I had material that had a large amount of sulphur I should put in more lime.

Q. Why?

A. Because lime takes up the sulphur and carries it off in the slag.

Q. If you get sulphur in your ore, but do not increase the quantity of lime, what would be the effect upon the operation of the furnace?

A. You would not get quite as good iron, because the sulphur would go into the iron.

Q. Is that the reason you would put in more lime?

A. Yes, sir,

Q. Is not the effect of the sulphur to make the slag less liquid than otherwise, so that you put in lime to make the slag liquid, do you not?

A. We use lime to absorb the materials you want to carry away.

Q. If you have a material with sulphur and another that has not got sulphur you would put in an increased quantity of lime to make it operate well?

A. Yes, sir; and to make good iron.

Q. Increased quantity of lime would increase the quantity of carbonic acid gas which was produced, would it?

A. I do not know. All that takes place when the gases from the limestone are driven off. I cannot tell.

293 Q. You cannot say that an increased quantity of lime to a given formula for charging a furnace, owing to the presence of sulphur, does injure the quantity of gases?

A. I think it might if you put in too much. There is a difference of opinion as to the effect of the carbon in limestone among scientific men and I do not pretend to be expert enough on that point to settle the question.

Q. Now, after we have gone over what we have, let us come back to *to* the question and explain to us wherein and how the machinery itself effects the quantity or quality of burning gases per ton of iron.

A. If you have not sufficient power of boilers and engines to blow the furnace up to its capacity or to blow the furnace the amount of

air it needs it very seriously effects both the quantity and quality of the gas. By blowing a less amount of air into the furnace than it requires usually produces a gas with less heating power than if the furnace was blown as it should be. With deficient boiler power and deficient engine power no furnace can be successfully run.

Q. Does not the quantity and quality of the burning gases, coming from the top of the furnace, depend upon the condition of the furnace and the materials that are put in it? If they are consumed therein and turned out in the shape of gases above and melted materials below?

A. If you call air a material I say yes.

Q. Explain how that effects it. The air is the blast, is it not, and that's one of the materials?

A. Yes, sir; air is one of the substances that is put into the furnace and upon the amount and condition of which depends very largely the successful working of the furnace.

Q. Doesn't it depend upon other materials?

A. Yes, sir.

Q. It depends, then, on the condition of the furnace inside and the materials put in the top?

A. No, sir; not altogether that way either.

Q. Why not and where not?

A. If the furnace is burdened all right and you fail to get the proper blast you cannot get the proper result.

Q. What's a proper blast?

A. Whatever the circumstances might be.

Q. The furnace is filled with air from the bottom and ore,
294 coke, and limestone from the top?

A. Yes, sir.

Q. Into the top you put in certain materials. If the material at the bottom is uniform and the gas comes from the top is not the gas dependent, as to quantity and quality, upon the materials which are put in at the top and the varying conditions of the interior of the furnace, permitting combustion in a more or less complete manner?

A. Not absolutely, from the statements you make; it depends very largely upon the heat and quantity of the air.

Q. I have taken that to be uniform.

A. Then, I suppose, your supposition would be correct. If I understand your question, that with a constant amount of air at a constant heat at the bottom of the furnace, then the gases will depend upon the materials put in at the top of the furnace and would vary accordingly if the furnace was working in a perfect condition.

Q. Is the burning quality of the gases diminished by an increase in lime?

A. If you just had exact enough lime on the furnace and put more lime on than ought to be on the furnace to flux all other materials I think it would probably effect the gases to their detriment, but in putting on more lime it might effect the temperature of the furnace and in the regular working of it you might get gases that would have better heating qualities.

Q. Do you know of any such ever being done?

A. Yes, sir; frequently.

Q. How does an increase in lime give better gases?

A. By putting on more limestone the furnace might work irregularly and thereby you might produce more carbonic oxide than you would if you had been working along regularly with a regular amount of lime.

Q. How does putting on more lime make it irregularly, and how does working irregularly with more lime increase the carbonic oxide?

A. I cannot explain exactly. You might get a scaffolding on the bosh, and furnace thereby work irregularly, too much carbonic oxide gas be produced, and this increase the heating power of the gases. I state that as an irregular working of the furnace.

295 Q. Does an irregular working of the furnace cause it to produce more carbonic oxide or acid gas?

A. Generally more carbonic oxide gas than when it is working regularly.

Q. Why is an irregular working of the furnace from those scaffolds on the sides more apt to produce more carbonic oxide than carbonic acid?

A. Because the gases going through the furnace do not do their work properly, and when they do not do their work properly there is a large percentage of carbonic oxide gas going out of the top of the furnace.

Q. Carbonic oxide gas is what you want to produce heat?

A. Yes, sir.

Q. Then these scaffolds are desirable?

A. No, sir.

Q. They do produce carbonic oxide gas?

A. Yes, sir.

Q. Why?

A. I cannot explain it fully.

Q. Can you do it at all?

A. I do not think I could go ahead and tell you the exact thing that is supposed to be done in a furnace.

Q. Never having been there?

A. No, sir.

Q. You think, then, as a fact, that you get more and better burning gas when it is working irregularly from having too much lime in it or from any other cause than you do when working regularly?

A. Yes, sir.

Q. As a chemist?

A. I do not profess to be a chemist.

Q. What phenomena gives you that fact, did you analyze them?

A. The heat resulting from burning the gases.

Q. You say that the furnace is scaffolded by the hanging of materials on the side?

A. Yes, sir.

Q. Would it necessarily be the cause?

A. I think it would, necessarily.

Q. That irregular working increases the carbonic oxide rather than the acid?

A. Yes, sir.

Q. Can the burning quality of the gases obtained relieve the quantity of carbonic oxide and carbonic acid in the gases?

A. The above question is not intelligible.

Q. You admit that an increase in lime, other things being
296 equal, would diminish the heating quality of the gases?

A. If the furnace kept working regularly.

Q. Everything being equal, an addition of lime would decrease the quality of gases?

A. Yes, sir; in working regularly and the furnace was not cooled thereby.

Q. If you put into two furnaces exactly the same charge and the heat and everything being equal, except into one you put more lime than in the other, will not the gases from that furnace be inferior to those from the other?

A. Yes, sir; it might be.

Q. An addition of lime, caused in one case by an increased quantity of sulphur present in the materials, while it might act as a flux in the heavy materials at the bottom, would it not have precisely the same effect as to the materials that go out of the top as if the sulphur had not been there and the lime had not been added?

A. Possibly it would.

Q. Would it absolutely?

A. I do not know, but think not.

Q. The lime that is put into the top of the furnace, when it goes to the bottom and subjected to the heat, is resolved into two or three constituent gases, which go out at the top, and the lime at the bottom which acts as a flux to the material inside?

A. It is resolved into different constituents, undoubtedly.

Q. You put an additional amount of lime to flux the sulphur so as to unite as slag at the bottom, and that leave- the gaseous constituents of the lime to go out among the other materials?

A. I am not sure; there might be some change in the gaseous constituents in passing through the furnace.

Q. You do not know of any?

A. I cannot say that there is or is not.

Q. Do you know of any?

A. I do not personally; I only know of what I have read from books—some authors take one view of it and some another.

Q. What pressure of blast do you run upon these engines?

A. From 7 to 9 lbs. to the square inch when we have plenty
297 of power to blow the engines.

Q. Sometimes more and sometimes less?

A. It varies very seldom less than 7 lbs., unless the pressure of steam goes down and prevents blowing harder.

Q. How many revolutions to that engine per minute?

A. Well, about 28 to 33 to each engine.

Q. How many revolutions of a single engine do you calculate it requires per ton of iron?

A. I have never made the calculation.

Q. You do not know how many revolutions of a single engine it takes to produce a ton of iron?

A. No, sir.

Q. Do you know what quantity of blast it takes to consume a pound of carbon?

A. I cannot tell from memory now. I can answer that question in a general way.

We blow three engines with thirty revolutions each, and, if the furnace is working well, we make from 115 to 130 tons of iron per day; might possibly run a little more on some days.

Q. What connection have you with this concern now?

A. Receiver.

Q. What other interest have you in it?

A. Not any.

Q. Ever had any?

A. No, sir.

Q. You took charge on the 20th or 22d of October?

A. My impression is that it was the 20th—somewhere along there.

Q. Who had had charge of it for the previous month?

A. Mr. Doud, I think.

Q. In whose employ was he?

A. In the employ of the Sheffield & Birmingham Coal, Iron & R'y Co.

Q. In what capacity?

A. As superintendent, I think, of the furnace department.

Q. Do you know what Mr. Doud's present employment is?

A. I do not know what his title is. He has charge of Col. Ensley's furnaces at Sheffield.

Q. Do you know him?

A. Yes, sir.

Q. For how long?

298 A. I think I met him as long ago as 1875, but I had known nothing of him until I came to Alabama, some two and a half years ago.

Q. He is an ironman, is he?

A. Yes, sir.

Q. Do you know anything of his capacity?

A. I think he is a good furnaceman. His reputation is such.

Q. What is the ordinary pressure of blast used at furnaces generally?

A. From five to twelve pounds.

Q. Do you know where twelve pounds was ever used?

A. Yes, sir.

Q. Where?

A. At the Edgar Thompson steel works, in Pennsylvania.

Q. Who is in immediate charge of this furnace, so far as charging it is concerned?

A. Mr. Alexander McIlwaine.

Q. Who furnishes to him the formulas for the charge?

A. He makes out the formulas himself, as a general thing, and frequently consults me.

Q. You have nothing to do with the charging?

A. He charges it and sometimes comes to me and consults about it.

Q. He is in practical charge of the duties of running the furnace?

A. Yes; practically.

Q. I would like for you, as an iron expert, take the following constituents of ore, coke, etc., and tell me in what proportion you would charge a furnace, viz:

| | Ore No. 1. | Ore No. 2. |
|---|---|---|
| Pure metallic iron | 45.12 | 46.87 |
| Oxygen with iron | 19.28 | 20.09 |
| Silica | 16.27 | 15.30 |
| Water | 12.24 | 10.903 |
| Alumina | 4.38 | 3.657 |
| Lime carbonate | 0.19 | 0.87 |
| Magnesic " | trace | 0.282 |
| Phosphoric acid | 1.945 | 1.160 |
| 299 Sulphuric acid | none | 0.030 |
| Undetermined and lost | 5.75 | |
| Manganese | 0.00 | .857 |

| Lime. | | Coke. | |
|---|---|---|---|
| Carbonate of lime | 97.13 | Carbon | 90.00 |
| " " magnesia. | 1.05 | Ash | 7.40 |
| Silica | 0.86 | Sulphur | 0.75 |
| Oxide of iron | 0.19 | | |
| Alumina | 0.22 | | |
| Phosphorus | .0083 | | |
| Undetermined & water | .5417 | | |

*Analysis of Ash.*

| | |
|---|---|
| Silica | 51.00 |
| Alumina | 25.00 |
| Lime | 2.00 |
| Magnesia | 1.00 |
| Ferric oxide | 15.00 |

With foregoing material how would you charge a furnace, using half quantities of the two iron ores? The furnace being in full operation, what burden (or proportion of ore to coke) would you put on it of the foregoing iron ore, using half of each? What should be the analysis of a slag from such materials used as above supposed?

A. I would use, with temperature of blast 1,200° F., using brown hematite ore and a good compact coke, 50% of coke to the ore, 32% of limestone to the ore. If, after trying this mixture, I found I had a little too much or too little of ore or limestone, I would change it.

Q. Do you intend this as an answer to my question?

A. I intend it as all the answer I am going to give.

Q. Why did you use brown hematite ore; did I say Brown hematite?

A. No, sir; but your question was an unintelligible one unless you did use brown hematite.

Q. You say the question was not intelligible by not characterizing the ore than by the analysis?

300 A. No, sir; unless you indicated it was combined water.

Q. How do you characterize an ore except by analysis?

A. By practical test; but it is always best to have the analysis.

Q. Is not analysis mostly used in characterizing the ore? Is not this the test that all scientific men give to ore?

A. Yes; they generally analyze them.

Q. Which, in your opinion, is more liable to make a mistake, the scientific man or the practical man?

A. The scientific rather than the practical man, in the practical operation of a furnace.

Q. Why did you use brown hematite?

A. Because I wanted to know how much coke to use.

Q. How much coke would you supply with the ore I gave you?

A. If brown hematite, same as I gave you before.

Q. You take this formula from your practical experience?

A. Yes, sir; also from analysis.

Q. Why do you say that the question embracing the analysis of the ores I gave you are not intelligible without the ore being characterized by some general name?

A. I suppose I may have said that a little strongly. If you had made the water combined water in the analysis it would have indicated that it is brown hematite ore, and I wanted to fix that in my answer.

Q. You supposed that these ores that I gave you were brown hematite?

A. Yes. sir.

Q. And you fixed up your formulas from brown hematite and not from the analysis given?

A. No; the analysis has something to do with it; I made up the mixture from the analysis, considering it to be brown hematite. *Brown hematite may not have more than eight per cent. silica, and then it would be a different mixture. It might be down to six per cent.

Q. If it had more or less silica in the iron ore, what change would you make in the formula?

A. I would add more limestone and a little less fuel.

301 Q. You do not regard the analysis of the slag in determin-g the formula for charging the furnace at all?

A. If I had trouble with the furnace and could not account for it I would then analyze the slag.

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(*The latter part of this answer must be in answer to some question that has been omitted.)

Q. The constituency of the slag will itself determine whether or not the charge is improper? Practically, it does indicate errors in charging, does it not?

A. If I had slag that has thirty per cent. alumina and not more than thirty per cent. silica I should think it needed some change in burdening.

Q. What change would you make?

A. I would so charge the furnace as to carry the silica high and the alumina lower.

Q. Since you have had charge of the furnace you know what slipping in the furnace is, do you not?

A. Yes, sir.

Q. Do you know what this was caused by?

A. It was caused by hanging.

Q. Have you had much of that?

A. Had some the first five or six weeks; not much since.

Q. Has the turnout in the iron in your furnace been pretty regular in the main?

A. I do not know what you would call regular. Some days we have made as high as 140 tons and some days not more than seventy-five.

Q. A good deal of that irregularity?

A. No; I think the furnace would run with a great deal of regularity if we had the boiler power to blow it regularly.

Q. Your furnace has not been turning out iron with regularity?

A. Yes; I must say it has; about as regular as any furnace, with the exception of when I have been obliged to stop to make repairs.

Q. Referring back to the written question proposed to you, if you had nothing to go by but the analysis which I have given you, how would you charge a furnace on these papers?

A. I would charge it as I have stated.

Q. Suppose you had in the furnace the following, 1,651.8 lbs. of silica, 497.5 lbs. of alumina, 1,898 lbs. lime, and 32.5 lbs. of magnesia in each charge, will you calculate and give us what
302 would be the percentage of each in the slag, allowing one-half per cent. of silica in the iron?

A. No; I will not calculate it.

Q. Why will you not make the calculation?

A. One reason is that I do not retain in my mind the exact percentage of the parts that might be eliminated by being melted. I would just say I will not answer it.

Q. How does the silicon in the iron disappear except in the percentage that goes in the iron and the percentage that is left in the slag?

A. The oxide of silicon, as I understand, is silica, and, being melted, the oxygen is eliminated, and the silicon goes into the iron and slag.

Q. Is not the portion of the oxygen of the silica in the furnace farther reduced than that portion which goes into the iron?

A. I cannot tell you; I do not know whether all the silica in the

furnace is reduced to silicon and then recombined with oxygen so as to come out of the furnace as silica in the slag.

Q. Then with those figures which we have given, in the present state of your knowledge, you are unable to calculate the percentage of each in the slag?

A. No; I do not think I could do that without referring to the formulas in the book, though I might get very near it.

Q. In testing the efficiency of the engines are there not some scientific instruments for doing so?

A. Yes, sir.

Q. Do you understand them?

A. No, sir.

Q. You know what they are?

A. Yes, sir; I have seen them used.

Q. You don't know anything about their practical accuracy?

A. I never tried them; have only seen them used.

Q. You state these engines were pumping over the water from the boilers?

A. Yes, sir.

Q. The only place they could get water was through these steam pipes?

A. Yes; but I think the heaters may have leaked, and the water escaping from the exhaust pipes might be in part that from the heaters.

Q. The supply of water in the engines is a reduction from steam in the boilers?

A. Yes; either from the boilers or from condensation of steam.

303 Q. That water would come over bodily from the boilers or by being reduced. Where did the water come from in this case?

A. So far as we could discover, it came from the boilers.

Q. In what shape—water or steam?

A. I can only judge from the way it comes out of the escaped-steam pipe; it apparently comes out there in the shape of water.

Q. Where is the escape pipe?

A. On the top of the engine-house.

Q. The escaped steam is after the steam has passed through the engine?

A. Yes, sir.

Q. May not the water which you say escaped from the steam pipe have been steam when it left the boilers and turned into water at the time you saw it escaping?

A. I have no doubt a portion of it was condensed steam.

Q. In your experience is not steam condensed more rapidly in pipes that are uncovered than in pipes that are covered?

A. Yes, sir.

Q. Then good management dictates that all steam pipes should be covered with non-conducting material, and the longer the pipes the more exposed they are, and carry a reduction of steam to water?

A. Yes, sir.

Q. Your pipes are how long?

A. The two pipes, one over the boiler and one in the engine-house, are in the neighborhood of 100 feet long, and the three pipes connecting these two pipes are each in the neighborhood of 45 feet.

Q. And none are covered?

A. All are covered.

Q. When were they covered?

A. Last fall, I think, in December.

Q. How are they covered?

A. With the J. M. McConnell non-conducting covering from Pittsburgh. There are a few feet, in taking out a pipe to put in a valve, where the covering was destroyed and has not yet been replaced.

Q. When you took charge of this pipe none of the plants were covered?

A. No, sir.

Q. The first pipe from the boilers and the three connecting pipes into the engine-house did not have a roof and were exposed to the rain?

A. Yes, sir.

Q. You have very heavy rains in that country, I suppose?

304 A. Yes, sir; the same as everywhere else, I suppose. In addition to the big 12-in. pipe being covered, I have had all other steam pipes, wherever I could, covered so as to save all the steam possible, and, in addition to that, I have had boards put over the pipes so as to shed the rain from them as much as possible.

By Mr. TOMPKINS:

Q. How many furnaces have you ever superintended the construction and been connected with the building of?

A. I have had direct and full charge of building three, got up the plans for a fourth, and assisted in getting up the plans and specifications of two more.

Q. Have you ever had charge directly or in connection with other people of blowing in any furnace?

A. I have always had charge as superintendent in looking after the blowing in.

Q. What was your success?

A. I never had any trouble in blowing in a furnace. I think I have had charge of blowing in not less than twenty; not twenty different furnaces, but furnaces to the amount of 20 or 25 different times.

Q. Do you think of anything else that you would like to state to the court connected with your practical knowledge of furnaces, furnace buildin-, and furnace management?

A. I do not know of anything further.

305 In the Intervention of GORDON, STROBEL & LAUREAU.

Continued cross-examination of JACOB G. CHAMBERLAIN.

Examination by Mr. GUNTER:

Q. You said in your direct examination that there was no system of valves between the boilers and the engines. Now, there was a 12-inch main steam pipe running the whole length of the boiler, wasn't there?

A. Yes.

Q. And that pipe was connected with each of the boilers?

A. Yes.

Q. And there was a valve between that pipe and each of the boilers?

A. Yes.

Q. That main steam pipe was connected with three other pipes to another main of the same size running parallel to it in the engine-house?

A. Yes.

Q. And from that main there was a connection with each one of the seven engines?

A. Yes.

Q. Was there not on each of the pipes connecting between each engine and that main in the engine-house two valves, one at the engine-house and one close up to the main?

A. Including the throttle valve at the engine, there was.

Q. This paper before you, this drawing, is a fair representation of the plan?

A. Yes. (Said drawing is marked Exhibit "A.")

Q. So that under the arrangements any engine or any boiler could at any time be shut off and repaired without interfering with the others?

A. Yes.

Q. In running furnaces there always are stoppages in a furnace for the purpose of drawing off the iron or slag during the day, are there not?

A. For drawing off the iron, not necessarily the slag.

Q. Well, then, when you draw off the iron you have to build up the hole, don't you?

A. Sometimes.

Q. And that requires extra stoppages, don't it?

A. Yes; when the hole is extra large it does.

306 Q. These twelve-inch mains, are there three connections from the general steam receptacle from the steam plant?

A. That is about all there is after the steam leaves the boiler.

(There is some error in the foregoing question; also in the answer.)

Q. And those steam mains are made of pipe with flange joints, are they not?

A. Yes; some of them; some of them may not be flange—probably they are flange.

Q. And they are made secure by inserting packing between the flanges?

A. Yes.

Q. Are they screwed up with bolts and nuts?

A. Yes.

Q. When these joints get out of order they do so by leaking between the flanges, do they not?

A. Yes; besides this sometimes they leak out under the flanges.

Q. If they get out of repair it is at those joints, is it not?

A. Generally at joints and when flanges are screwed on pipe, unless there is some serious accident that bursts the pipe.

Q. These pipes are in any length you please, commercially, are they not?

A. Yes.

Q. Are not these flanges screwed on and hammered on the inside so as to make the nuts tighter?

A. I do not know; they may have been hammered that way; very likely they were done that way; still there were some of them that leaked if they were hammered.

Q. Leaked at the screws?

A. Yes.

Q. You said that those pipes come in commercial sections so that they could fit—some of them long, some of them short?

A. Yes.

Q. Do you know anything about such a thing as a blind flange or a cut flange?

A. Yes.

Q. How long would it take, having everything prepared, to disconnect one of these flange joints in that main that might be leaking and to spring the pipe apart and to insert in that joint a blind flange and close it up?

A. I do not know; I think I will give you some evidence as to how long it did take in some instances.

307 Q. Suppose you look at this drawing; that a leak was at a given flange joint in any part of this main, could you not upon any of the stoppages during the day shut off the steam and insert a new packing in a very short time?

A. Sometimes in poor joints it has taken two hours.

Q. How many men did it take that long?

A. Probably all that could get around the pipe and work to advantage.

Q. How many bolts to a joint?

A. Eight, usually; in large pipes may be twelve or more.

Q. How long would it take with a cold chisel to cut them in two?

A. Go at it with a sledge you could cut it off pretty quick.

Q. You have no idea how long it would take to unscrew the bolts?

A. No; I will answer that to the best of my ability. I think those joints could be made anywhere from half an hour to two

hours; and, in general, I say that any one of those joints could be broken and a blind flange put in, and, by stopping, it could be repaired in from half an hour to two hours.

Q. Is not that of the flange the best and most reliable system of joints?

A. Yes; I think so.

Q. State what circumstances would enlarge the time of repairing these joints from half an hour to two hours. What would make it two hours rather than half an hour?

A. There might be a difficulty in getting the bolts out; then we might have to send one hundred miles to get those.

Q. Supposing the bolts and packing were at hand and you had an expert machinist to cut or unscrew the bolts, what would occur?

A. I cannot tell all the contingencies that might come in.

Q. Name any. These could be chopped off in a few minutes?

A. Yes; one of the contingencies is, you might break a flange that you did not look for and it might take a long time to fix it.

Q. Ordinarily half an hour would repair any one of them, with the bolts and packing at hand, would it not?

A. It might be done; not ordinarily.

Q. You said something about a pumping arrangement. There was a large reservoir at your plant?

A. Yes.

308 Q. And there was a line of pipe from two pumps at the river?

A. Yes.

Q. There was a pipe extending from the main pipe of the boiler down to the river?

A. Yes.

Q. Was that to conduct steam to the pumps at the river which pump the water up the line of pipe to the reservoir?

A. Yes.

Q. And just before entering the reservoir there was a branch pipe extending to the tanks?

A. Yes.

Q. And on the pipe entering into the reservoir beyond the pipe which branched to the tank there was a valve?

A. Yes.

Q. And on this branch pipe extending from the pipe coming from the river and running to the tank there was another valve?

A. Yes.

Q. So that in case the pumps at the pump-house got out of order so that they could not run the pumps at the river could turn from running the water into the reservoir and run into the tanks?

A. Yes.

Q. So as to serve the whole plant. Is that correct?

A. Yes; the pipe continues from the tank and serves the whole plant. It empties into the tank and goes on.

Q. So that if the tanks got out of order it could be run to serve the tanks without running into the tanks?

A. Yes.

Q. There was also a connection between the main steam pipe in the engine-house and the pumps in the pump-house?

A. Yes.

Q. So that if the pumps at the river got out of order the pumps in the pump-house could pump the water from the reservoir for the whole plant until repairs could be made in the pumps at the river?

A. Yes.

Q. How many pumps at the river?

A. Two.

Q. How many at the pump-house?

A. Three.

Q. Was it not so arranged that if any one pump got out of order it could be repaired without interfering with the others?

A. I think so.

Q. Your idea is that the pumps should not be connected with this main steam pipe extending over the boiler, but you should have another pipe over the boiler and connecting directly with the pumps at the river?

A. Yes; should be connected to large pipe, also connected
309 directly to each boiler.

Q. So it is right as far as it goes?

A. Yes; but there should be an independent line or pipe connecting with each boiler so that we could run steam to the river pumps when steam was shut off the large or main steam pipes. A pipe that would be sufficient to carry the steam down there is all that would be needed.

Q. There should be a duplicate except not of the same size?

A. Yes; on the boilers, so that steam could be taken from any one or all the boilers.

Q. The only reason that this independent pipe should exist then is to supply steam from this pipe over the boiler in case the large or main pipe is out of repair?

A. Yes.

Q. So as to supply steam for any set of boilers independent of any other set or independent of this main line of twelve-inch pipe to the river pump?

A. Yes.

Q. As the plant now exists can't any single boiler be shut on and off from the main steam pipe?

A. Yes.

Q. Does not that leave it so that the only reason for this independent main is that it may supply steam in the event the present main is out of order?

A. Yes.

Q. How long would the reservoir supply water to this plant?

A. I cannot tell; I never made any calculation.

Q. Have you no idea?

A. Yes, I have an idea; it might last for twenty-four hours or more.

Q. In the water arrangements it was fixed so that if the pumps at the river got out of order by any accident the whole plant could

be run by the pumps at the pump-house and the use of the reservoir for a day or so?

A. I said twenty-four hours, I think.

Q. Or, so that if the reservoir and the pumps at the pump-house or tanks got out of order, one or all, the pumps at the river could be used for supplying the whole plant until they could be repaired?

310 A. I do not know if the tanks were out of order how it would be.

Q. Did you not just say that this pipe from the river pumped into the tanks?

A. Yes, but not in regard to the tanks. I do not recollect the precise connection from the river system to the tanks. I do not recollect the nature or character of those valves.

Q. You have already stated that any one of the pumps could be repaired?

A. Yes.

Q. Could any of the tanks be shut off and repaired?

A. That brings to the other question that I am not able to answer.

Q. There were three pumps in the engine-house to supply the boilers with water?

A. Yes.

Q. They are along the front of the engine-house facing the boilers?

A. Yes.

Q. Each one of those could be shut off and the boiler supplied with the others?

A. Yes; if valves were in good condition.

Q. Either of the pumps could be shut off and taken out and the operations carried — with the other two?

A. If the valves were perfect you could.

Q. We come to another subject. Did you ever read the plans and specifications of this plant?

A. I think possibly I have, but I do not remember.

Q. You said in your direct examination, did you not, that the plant ought to have been made so that any one or all of the blowing engines might be turned to any single furnace?

A. I will refer to the evidence.

Q. Were you aware that the specifications provided that each of the seven blowing engines will be connected with the coal-blast main pipes, so that either of four engines may be used on one furnace by the aid of the 24-inch cut-off valve?

A. I do not know anything about the specifications.

Mr. WHITE: "State that that examination of the witness was not for the purpose of showing that the plant had not been con-

311 structed for the purpose of denying that specification."

Q. You state in your direct examination that the hot-blast main from the three sets of stoves should have been connected throughout and a system of valves introduced so that the hot blast from any set of stoves or from all the stoves might be turned on any single furnace?

A. Yes.

Q. What would be the length of that connecting main from outside to outside, about?

A. I do not know; from 250 to 300 feet; in the neighborhood of 300 feet.

Q. That would be continuous pipe through which the hot blast would go?

A. Yes.

Q. What is the heat of that hot blast?

A. About twelve hundred degrees.

Q. What would be the expansion in that pipe with twelve hundred degrees of heat?

A. I do not know.

Q. What is the maximum heat?

A. It might extend to fourteen hundred, ordinarily; twelve hundred.

Q. Does the sun shine up there?

A. I am not sure that it does; part of the time it does.

Q. Is it covered?

A. No; but *are* lined with brick on inside so that the iron does not get overhot.

Q. Doesn't the sun shine on everything that is not covered?

A. No.

Q. What is the approximate expansion and contraction arising from that twelve hundred degrees of heat?

A. I do not have any idea.

Q. In your statement that these pipes ought all to be connected you did not take into consideration, did you, the mechanical difficulty in keeping up the connection of these pipes with the stoves arising from the lateral expansion and contraction from such a length of pipe of fourteen hundred degrees of heat?

A. Not seriously.

Q. Would you swear, as a mechanical and mining engineer, that that was a serious difficulty?

312 A. I think there might be some difficulties arising from the connection, but they could be overcome.

Q. How?

A. By expanding joints.

Q. Did you ever see one made for hot-blast furnaces?

A. Yes.

Q. Three-hundred-feet main furnaces?

A. No; but two furnaces about one hundred an- thirty feet.

Q. These three sets of stoves are intended as separate equipments for separate furnaces?

A. Yes.

Q. And by the arrangement each set of stoves is reasonably necessary for the operation of each single furnace?

A. Yes.

Q. What would be the use of turning the equipments of three furnaces for the other furnaces?

A. In case they were separate and you should lose two of the

stoves—in case they were connected and any two of them should give out you could divide up the heat of all.

Q. Do you know the relative consumption of cubic feet of air to the pound of carbon in making iron?

A. I do not know without referring to the books.

Q. Do you know the quantity of air that you are using at this time to the pound of fuel?

A. No; but could be easily figured out.

Q. By knowing those rules a scientific man is enabled to tell whether a furnace is in proper condition. If he finds that he is using twice the quantity of air he is thereby enabled to tell that it is rising from some abnormal cause?

A. I cannot answer that; not in that way. If you will let me explain I might know all that. I might know how much it would take without knowing what the furnace is doing. If I knew how the furnace was working I could tell whether to blow more or less.

Q. Hot-air pipe connecting two furnaces? That was put in by Gordon was in what furnace?

A. The North Birmingham. I do not know that there was any expansion joints.

Q. Did you ever see one constructed with expansion joints?

313 A I have made hot-blast pipes with expansion joints myself and seen many others they made for the purpose of taking up the expansion in the pipe.

Redirect examination by Mr. WHITE:

Q. Are the coke, the coal, and the other materials that you have been using in the operation of that furnace particularly available in that furnace in the making of iron?

A. Yes.

Q. Operating that furnace in the manner suggested by your experience, have you been able or not to operate one of those furnaces with the two batteries or boilers and the engines designed for the operation of the other furnaces?

(Mr. Gunter objects to this question.)

A. I have not.

Q. Are those two boilers or the batteries and the two engines sufficient for the operation of that furnace?

A. No, sir.

Recross-examination by Mr. GUNTER:

Q. Do you know the usual quantity of heating surface in boilers allowed for in erecting furnaces and providing steam for the same?

A. No.

Q. Do you know any rule governing such matters?

A. The rule that I know best is the rule that furnish sufficient boilers to make steam to run the furnace up to its capacity.

Q. How would you know that if you did not know some rule?

A. I would take the safe guaranty of the man that built them.

Q. Did you not say that you furnished the plans and specifications yourself?

A. Yes.

Q. In making out the plans and specifications did you not provide for the size of the boilers and engines to be contracted for?

A. I suppose I did, and think that we had a guaranty; but I know this, we had to put in more boilers afterwards with the furnace I built first.

Q. Your guaranty from the manufacturers did not extend to guaranteeing that your specifications were correct, did it?

A. We were mistaken in the amount of steam required and had to add other boilers.

Q. How many plans and specifications have you ever furnished?

A. Four.

314 Q. Did you furnish plans and specifications besides the first?

A. Yes.

Q. Did you use any rule for making the plans and specifications?

A. I think my plans and specifications were drawn from my experience in the main.

Q. And your opinion in this is furnished more from practice than theory. What is the difference between practice and theory?

A. One is speculation and the other is actual knowledge by experience.

Q. Is not theory correct?

A. I know a good many that are not correct.

Q. You do not know any rule, except by your experience, in which to determine the amount of heating surface to be used in heating boilers in furnaces?

A. I do not recollect the rules for calculating heating surface of boilers to show power of engine.

Q. You did not have any better memory when you commenced than you have now?

A. No.

Q. Then your opinion in this examination are entirely based on your particular knowledge and not on rules? I ask you what your opinion is based on.

A. My opinion is based on what I could learn from books and twenty-five years' experience with plant furnaces.

J. G. CHAMBERLAIN.

*G. W. Killebrew.*

Direct examination by Mr. WHITE:

Q. Have you ever been engaged by the furnaces?

A. Yes.

Q. In what capacity?

A. When I was engaged around a furnace I was a laborer.

Q. Were you ever engaged on the furnace No. 2 of the Sheffield & Birmingham Coal, Iron and Railway Company?

A. Yes.

315 Q. How long?

A. About twelve months, or eleven.

Q. What did you do while so employed?

A. You might call me a general "roustabout." My principal business was to receive and unload stock, but sometimes when a man was off I would weigh the stock and take care of the yard work. When I first went there I assisted the fireman at the furnaces.

Q. Were you acquainted with the unloading and use of the coal by the boiler?

A. Yes; I included that in part of the stock.

Q. How much coal was used there in the operation of that boiler?

A. Our standing order was ten cars per week, with about twenty tons per car.

Q. Did you observe the operation of the boilers and the engines and furnaces during the eleven months you stayed there?

(Mr. Gunter objects.)

A. Yes; as much as I could.

Q. How many boilers were used to run one furnace?

A. I do not think we ever got along successfully without six.

Q. How many batteries?

A. Three.

Q. How many engines?

A. A great portion of the time as many as three; all the time as many as two.

Q. Have you ever been employed at any other furnace?

A. Yes; the Lady Ensley.

Q. How long ago?

A. A month or six weeks.

Q. What were your duties?

A. I was night founder.

Q. Do you know anything about the quantity of coal used at the Lady Ensley by the boilers?

A. Just enough used while I was there to keep the fire.

Q. The Lady Ensley is a single furnace, is it not?

A. Yes.

Q. What is the boiler power of the Lady Ensley?

(Mr. Gunter objects.)

A. They have eight boilers.

Cross-examination by Mr. GUNTER:

Q. Who is the manager of the Lady Ensley?

A. Major Doud.

Q. Is that the same Doud who was in charge of the other furnaces for awhile?

A. Yes.

316 *Alexander MacIlwain.*

Direct examination by Mr. WHITE:

Q. What is your present employment?
A. I am employed as founder of the Sheffield and Birmingham furnace.
Q. Does that furnace belong to the furnace of which Chamberlain is receiver?
A. So I understand.
Q. How long have you been employed in your present capacity?
A. Since the 20th of last October.
Q. Do you know anything about the quantity of coal that is used in connection with the boilers at the furnace?
A. We use two car-loads a day; three sometimes. The cars carry from eighteen to twenty tons; about twenty tons, on an average.
Q. Why is that used?

(Mr. Gunter objects.)

A. For the purpose of creating heat to make steam to run the engines with.
Q. Why is it that you do not get heat from the gases?

(Mr. Gunter objects.)

A. That would depend on whether the boilers are so constructed that we could receive gas enough to make heat; the boilers constructed the way they are, we cannot do that.
Q. Are those boilers so constructed as to enable you to get heat enough to operate them without this coal?
A. It seems not.
Q. Have you ever tried to do so?
A. Yes.
Q. How many boilers are there?
A. There are six batteries. They are in six blocks, and each contains two boilers, if they work separately.
Q. So, then, there are twelve boilers and six batteries. How many of these batteries does it take to operate one furnace?
A. It would take three, three and a half, or four.
Q. There would be eight boilers, then?
A. Yes.
Q. And you only have twelve?
A. Yes.
Q. How many engines?
A. Seven blast engines.
317 Q. How many is it necessary to employ to run one furnace?
A. If they were mine, I would not run one furnace with less than three; we are running three to make it a success.
Q. Then do I understand you to say that in order to run one

furnace successfully it would be necessary to use three, three and a half, or four batteries or boilers and at least three of the engines?

A. Yes; it takes three and a half batteries to get any steam so that we can fire and three engines to make it successfully.

Q. Why is it that you cannot operate that one furnace with the one-third boiler power that is there?

A. We do not get the steam to operate the engines.

Q. How do you know it?

A. In that one-third there would be two batteries; we have never tried less than two and a half, and we could not do it with that.

Q. Why is it that you cannot operate the furnaces with the boiler power that you find necessary with less than three engines?

A. Because I did not consider it safe to run the revolutions high enough.

Q. How many revolutions would be necessary to run two engines to operate the furnace successfully?

A. From eighty-seven to ninety or ninety-two a minute; that would be an average of *of* forty-five revolutions per minute to run one engine.

Q. What is the number of revolutions that you run each one of the engines when you run three engines to operate one furnace?

A. Twenty-seven, twenty-eight, or thirty, possibly; sometimes twenty-nine.

Q. Why is it not safe to run those engines at a greater revolution?

A. They are bolted down by four bolts, the bed plates, and the nuts. By running fast—that is, to run forty-five revolutions—the bed plate would move up and down in the seat, other parts of the machinery would come loose, and I thought fast running was the cause of it; therefore we use three engines.

Q. What has been the practical result of attempting to run the engines at forty-five revolutions per minute?

318 A. I do not think we ever run any higher than forty; that was my orders, and I do not think it was ever safe, and my reason was that the bed plate—one of them broke, and I did not think it safe, because the machinery—there was something wrong about it and the bed plate breaking.

Q. Just state in your way and as fully as you can all the defects connected with those engines and the reason why it was not safe to run those engines faster than the rate you now run.

A. One reason is, as I stated, the bed plate springs from the seat when we run at, say, forty revolutions per minute. There are four two-inch bolts, one in each corner of the plate, and these are screwed down all the time, or very often, to keep the bed plate in proper place; and when they are screwed down it causes the bed plate to raise in the seat, and I have broken two of them. I informed Mr. Chamberlain of the fact and he requested me when they sprung that way to keep that seat joined; accordingly as that side raised up we would fill in with this filling. That was his order and we did it with some of them. I also found that there were bolts under the cylinder that would come loose; also the bolts in the housings; by

running up to forty these were loose pretty much all the time and kept getting looser. Other defects were the piston head in the bone cylinder was cracked. I found that the iron was not uniform. It was very thin, as those holes would naturally be so from such a cause. After the head was taken out I was not very careful with it and turned it over and broke it in two or three places. That is how I found that the iron was not uniform in thickness. I do not think it safe, though I do not know whether the balance are in that condition or not. I would think that if those bolts were changed in some way they would not get loose as much as they do. The bed plate I do not know any remedy for, unless two more bolts were put in the seat where those bolts should be. That would make that much iron in the bed plate. That is the reason that I think the bed plate is not substantial. The valve seats—those were put in for the purpose of being blast valves in the entire cylinder. Those did not give satisfaction. They seemed to be too heavy, or for some reason when that wood became
319 worn out would not set properly. They were done away with and leather sets put in. Those valves we had were too small. They did not leave an inlet for the base sets, and putting in the leather in the same place there was not space enough and the leather sprung, and we had to get those sets turned off. I do not know how much, but enough to stop it from leaking. The leather did not give satisfaction alone, so we put in sheet iron. Some of them are in work and the leather still springs. There are four engines attached to the boiler. Those four should blow into one pipe, and if any of those are broken and you cannot blow it you have to blow from one of the others into the pipe attached to one of the engines. The air passes out of the pipe into the engine in order to get into the furnace. This is a serious defect. Another is that I have several times quarreled with my machinists because they did not keep the packing tight in the cylinder, and for some cause we could not keep the packing set out as in other engines. Those are the principal defects.

Q. Taking all of the engines, and considering that they are built so as to have operated all three of the furnaces that that plan embraces at once, do you or not consider that those are heavy enough and substantial enough for the purposes for which they are intended?

A. From what experience I have had and from what I have seen since last October, if I was asked to run three of those engines I think I would resign. I do not think they are capable of blowing three furnaces as they should be blown.

Q. Do you or not mean by the words "as they should be blown" running three furnaces upon substantially their reasonable capacity; do you mean that the engines could not do that work?

A. I would not undertake it.

Q. Do you know anything about the system or set of valves about the plant that has been put in since you have been there?

A. Yes; I think so.

Q. Do you consider that it was necessary and proper thing to have valves and pipes put in as they should be?

A. Yes; to make it safe.

Q. I want to know if the whole system of pipes and valves, as they have been put in and added to that furnace plant by
320 the direction of Mr. Chamberlain since you have been there, were necessary and proper to be put in.

A. Yes.

Q. What experience have you had as a furnaceman during your lifetime, where did you start in the furnaces, and with what furnaces have you been connected, and over what period of years did that extend? We want to understand what particular connections you have had.

A. In 1864 (I was then thirteen or fourteen) the first thing I did was to drive a cart with a horse to it at a furnace—Monticello furnace, Armstrong county, Pennsylvania. My next work was wheeling coal to put into the furnace; occupied about nine months in both. I went to Honewood, Beaver county, Pa., and was there a year and a half or two years, and did all kinds of common labor outside of regular furnace work; drove a team, shovelled coal. I do not remember the exact time; that furnace stopped then. I went to Mineral Ridge, Ohio; there were two furnaces there. I worked at laboring work there for awhile—what we term a "standing turn" at the furnaces—that is, taking snapping cinder, pulling cinder out of the furnace, filled coal, took out iron, and other laboring work around the furnaces; spent two years in a coal mine (not the Birmingham, though); it was another coal mine. I then went to Irondale, Jefferson county, Ohio. They had a furnace for crushing ores and stone by steam; had charge there. I left there and went to Cherry Valley iron works. (Mr. Gunter objects.) I was there as a laborer, helper, keeper, and night founder. I left there and went to Moxahala, Ohio. I was there at the boiler from the time it started till it was completed; I was night founder for nine months. I went from there to West Virginia; was at the furnace there for three or four months as keeper and night founder; came back and got charge of a furnace in Hocking county, Ohio; had charge about two years. Went from there to Lowell, Ohio; had charge of that for nine months while it was in blast and three months after. From there I went to Cherry valley, and had charge there for nearly three years; went to Milwaukee, Wisconsin; had charge of the furnace there nearly a year; came South to Sloss's furnace; was on the night team as
321 night founder for a month; next in Sheffield, where I am at the present time; been there since the 20th of October; was there a few days before, but went to work on that day.

Cross-examination by Mr. GUNTER:

Q. What is your age now?

A. Thirty-eight. I will be thirty-nine shortly.

Q. You say now you are—what are you?

A. Founderman.

Q. What does he do?

A. Has charge of the furnaces, mixtures of the different stocks, sees that the labor is performed in proper shape. He puts the burden on.

Q. Who makes the fuel for burdening?

A. I do.

Q. By what rule do you go? Do you have an analysis of the ores?

A. They have got analysis. I put in ore and limestone; if I want more lime I put it in.

Q. And you are governed by the slag to determine whether it is truly burdened?

A. Yes.

Q. Anybody has to do that unless they go by the analysis, do they not?

A. I do not know whether they could do anything else or not.

Q. Do you go by the appearance of the slag or by the analysis?

A. The appearance of the slag.

Q. Do you use different ores or the same?

A. Different names; the analysis is a little different.

Q. But you do not admit that unless you see it in this slag?

A. I am not a chemist. I do not get any analysis. I might get them if I would wish.

Q. You are not a mechanical engineer, are you?

A. No.

Q. There is a great difference in different co kes and ores?

A. Yes.

Q. Your ores are all thrown together?

A. I keep them separate for awhile; now I am using them altogether.

Q. Do you know the weight of those engines?

A. No.

Q. What is the diameter of the cylinder?

322 A. I think thirty-six inches.

Q. Do you know what development of horse power is necessary to run an engine of the size of these?

A. I do not know anything about horse power. I know when I get blast enough.

Q. How many revolutions ought you to have to the ton of iron?

A. I could not tell.

Q. Those are plate engines?

A. Yes.

Q. They set on a bed and the piston moves up and down?

A. Yes.

Q. Explain what there is about the movement of that piston that would tend to move the bed plate up and down. Is not the pressure of the engine as contained in the engine itself—does it not tend to push it off the bed plate?

A. The bed plate raises.

Q. How?

A. I do not know.

Q. Could not that engine be set up on a table and be run without being bolted down?

A. If it run at forty revolutions I would not want to be around.

Q. How much iron do you make per day?

A. One hundred tons, average; possibly a little more.

Q. Is it not very weak sometimes?

A. Sometimes.

Q. What regulates the quantity and quality of gas which you get from the furnaces; the gas comes from the top of the furnace, does it not?

A. I do not know that anything determines the quantity and quality of the gas; I do not understand you.

Q. Sometimes the gas is more or less and sometimes it is better than others. What determines the quantity and quality?

A. You do not get enough steam and the blast is shut off. If the blast does not go into the furnace to make the gas, the gas will not burn as a general thing.

Q. For the production of a furnace of the size of this, we will say that it is not.

A. I do not know of any that were as large.

Q. In burning the gas you mix it with air, do you not?

323 A. Sometimes we give it a little more.

Q. Have you any rule for regulating that?

A. If we see that it wants air we give it some.

Q. Is the quantity of the gas influenced by the quantity of the limestone that you use?

A. Has not effected it with us. I have seen furnaces where it did affect it.

Q. According to your judgment you think there could be valves in all these mains of the steam pipe?

A. They are in now; they should have been in — the first place.

Q. You have got valves in this main over the boiler?

A. Yes; four.

Re-examination by Judge TOMPKINS:

Q. In the operation of furnaces, is it not true that the output of iron from day to day always varies more or less?

A. As a general thing, especially when they are worn more than when they are new; always do vary.

*Testimony of Henry C. Brown.*

Direct examination by Judge TOMPKINS:

Q. What is your profession?

A. I am a machinist.

Q. How long have you been a machinist?

A. Since 1864.

Q. Have you ever been a machinist about a furnace?

A. I have been working on furnace-work about seven years.

Q. Have you ever worked on this furnace No. 2 of the Sheffield & Birmingham Coal, Iron & Railway Company?

A. I have been working on the engines continuously for six weeks.

Q. What defects have you found?

A. The bed plates are very light, with not a sufficient number of foundation bolts in them. I have found the pedestal bolts weak and several broken, and there is no chance to get them back again on account of the faulty construction of the bolts and the pedestal; cannot get the bolts into the pedestal, as there is no chance of getting them in without taking the wheels off or taking the steam cylinder off.

Q. What do you think was the cause of the bed plate breaking?

324 A. The spring, not having any foundation bolts in the middle, springing up and down; cannot see any other cause. They still spring continually.

Q. What do you think is the greatest number of revolutions that those engines can be run at with safety?

A. That, I believe, would depend on the amount of air pressure you are drawing.

Q. What do you mean by that?

A. If you are blowing five pounds you can run at a higher speed than at ten pounds. I would not like to be around there with ten pounds air pressure, running at forty revolutions per minute.

Q. Would it be dangerous?

A. I believe it would.

Q. With five pounds air pressure and fifty revolutions per minute would two engines run one furnace?

A. That depends upon the air pressure.

Q. With eight or nine pounds of air pressure could those engines be run forty-eight revolutions with safety?

A. I would not trust it.

Q. What would be the result in your opinion?

A. It is probable that something would break, and when a thing gives way you never know where it is going to stop at. It might be that only one thing would be broken. I think it would be dangerous.

Q. From what you have seen of those engines and boilers and the amount of air pressure or ballast required to run one furnace, do you believe that two batteries or boilers and two engines will be sufficient to run one furnace?

A. They do not appear to be able to get the work out of two engines at the present time.

Q. How many do they use?

A. Three.

Q. How many batteries?

A. I never paid any particular attention.

Q. From what you have seen of these engines during the six weeks you have been there, do they require more labor and expense to keep them in repair than engines of that kind generally do?

A. Apparently they do.

Q. Could extra holding bolts be put in the bed plates?

325 A. Not conveniently.

Q. If you were to bore additional holes through the bed plates in order to put in additional bolts, would it or not weaken the bed plate?

A. No, sir.

Q. From what you have seen of those engines, do you or not consider that they are too light in construction and material for the purpose of running one furnace with two engines?

A. In some places they are light, others strong. The bolts are weakest. They give way most.

Q. Have you ever had occasion to examine the engines in other furnaces?

A. Yes.

Q. How have they compared in construction and design with these?

A. Very favorably. Some are much better in places. Most all of them have some weak parts, but I don't find any giving way as these have been doing.

Q. Have you examined the system of valves and sets lately put in?

A. A little.

Q. Do you or not think they are necessary for the safe running?

A. For the safe running and convenience; if anything happened before it was necessary to shut them all down to get at one.

Cross-examination by Mr. GUNTER:

Q. You said that you could not get at one without shutting all down?

A. You could not get at any joints without shutting all down.

Q. They join by what is known as a flange joint?

A. Yes.

Q. How long does it take a machinist to repair them?

A. That is an indefinite quantity.

Q. Sometimes you would cut them off with one blow and sometimes with twenty?

A. I suppose it would take all the way from one and a half to two hours.

Q. In running furnaces they have stoppages, do they not?

A. At times, I believe.

Q. You do not know how long it takes to blow the iron off?

A. No.

326 Q. You say that you do not find the engines at other furnaces giving way like these. What other furnaces did you ever serve at as a machinist?

A. None of them. I was not working at the Sheffield furnaces. I was just sent there by the Williamson Iron Company.

Q. Have you been sent to any others?

A. The Alice Dixon and the Mary Pratt.
Q. Have you been at Sheffield for the last six weeks?
A. Yes.
Q. You were not there before?
A. No.
Q. You never saw this machinery until about six weeks ago?
A. No.
Q. Did you work on the engines at the Alice?
A. Yes.
Q. At the Mary Pratt?
A. Yes.
Q. What did you think of those?
A. They were working very well the last time I saw them.
Q. How many times did you work at those furnaces?
A. Worked at the Alice once and the Mary Pratt twice.
Q. You do not know which was the heaviest?
A. The Mary Pratt is smaller than this. I had to put in counter-wheels.
Q. But the point is that they break so easily. The pedestal holds the caps down on the shaft. What holds the shaft up?
A. The bearing on the bottom. There are four pedestal bolts on the main shaft, one on each corner.
Q. And you say there is no way to get them off without taking the pedestal cylinder off or the wheels off. The shaft will not lift up high enough.
A. We now try three bolts, two or three pedestals.
Q. Suppose another bolt was to break, what would you do?
A. Jack it down, I reckon.
Q. Couldn't you get at it to get it out?
A. I could not get at it.
Q. How many bolts are broken?
A. Two.
Q. How big are they?
327 A. One and a quarter inch, six or eight inches long. They spring into sockets.
Q. You are a machinist, are you?
A. Yes.
Q. Suppose the cylinder is standing upright under the bed plate and the steam moves into the cylinder, and the engine has been standing some time with an accumulation of water in the bottom of the cyliner, and the engine is started off suddenly and the piston comes down and strikes against that water, what would be the result?
A. It would stop the engine and knock the bottom out.
Q. Could it not operate to break the bolts you referred to?
A. It is not likely.
Q. The piston comes down too near the seat, and this bottom is very near the bottom of the bed, and the cylinder being very strong, would not the effort of the wheel to pass this joint and get around be to raise the shaft and get around?
A. It would be the contest between them.

Q. Explain to the court how else, in your opinion as a machinist, those bolts holding down that cap could be broken in the running of an engine.

A. I have seen those lifting an eighth of an inch with only five pounds of air; they might be lifted up and down all the time. It was from the lifting of the piston in passing those joints.

Q. What is the cause of this?

A. The pressure of air in the steam cylinder.

Q. The steam comes in here (pointing) and pushes the piston down there and lifts the shaft. Now, then, in running an engine are there not steam drip-cocks down there at each end of the cylinder to let out any cushion of water that might be there?

A. They are to let out the water; for that purpose and that alone.

Q. There is another exit for the steam, is there not?

A. Through the exhaust pipe.

Q. The cushion of steam goes out with the exhaust?

A. The cushion of steam raises the wheels because there is too much pressure.

Q. How is that to be remedied?

328 A. Take the steam cushion off; don't give her steam until she presses the seat.

Q. In the proper running of an engine there would be no steam cushion?

A. No; there hadn't ought to be.

Q. And there ought not to be any water cushion?

A. No.

Q. And this strain on those bolts must arise from some cushion of some sort in the cylinder?

A. Yes.

Q. You can put the lead on or off on any engine?

A. Yes.

Q. And it has nothing to do with the construction?

A. No.

Q. The cushion and lead are in the management?

A. Yes.

Q. The bed plates would not get this falling water if the shaft did not rise and fall?

A. No.

Q. If this cushion was not here the shaft would not lift, and if it did not the bed plates would get these licks?

A. No.

Re-examination by Judge TOMPKINS:

Q. You said that there should be something at the bottom of the cylinder. What was it?

A. I call it a drip-cock.

Q. They are always open at the time of starting?

A. I have never seen one of them left closed yet.

Q. Do you say or not that if that engine was fastened with more caps that rising and falling of the bed plates would not occur?

A. I think not; the bed plates would be more secure.

329 *Rebuttal Testimony of Alex. H. McIlwaine.*

EXHIBIT "D," A. MCILWAINE. Filed in clerk's office July 19th, 1890. A. W. McCullough, clerk.

330 ALEX. H. MCILWAINE recalled by respondents in rebuttal of complainant's testimony.

By Mr. WHITE:

Q. What position did you hold at these furnaces?

A. I was employed as superintendent.

Q. What are the instructions, if any, to the engineers or managers of these engines about stopping and starting the engines?

A. When we stop at casting time a signal is given by blowing a whistle.

Q. What is direction about starting the engines?

A. The orders were to open the throttle valve, turn on the steam, and use leavers. That is my orders. They are not supposed to be connected with the eccentric when they start.

Q. If they were started or stopped suddenly by uncoupling, it was against the orders of the management?

A. Yes, sir.

Q. Did you ever notice any thumping anywhere in the engines?

A. Yes, sir; I have noticed some.

Q. What caused that thumping?

A. The brass valves in the air cylinders caused considerable thumping.

Q. Would a person going into the engine-house be able to determine at once without an examination whether that thumping was caused by water in the cylinder or by excessive lead or from the valves?

A. Possibly an expert might, but a common man would not know where it was without examining it.

Q. What is the custom or habit of the management of that plant to have the boilers cleaned?

A. The flues are supposed to be kept clean by the firemen, and the water tenders sees that is done. It is the rule to do it whenever they get dirty, but as a general thing once a day and oftener if necessary; but I did not give orders to blow them off at night.

Q. Then you had them washed once a day?

A. As a general thing, one, not all of them. We have a
331 steam hose for that purpose, with a connection with the boilers.

Q. They are cleaned in the manner that they were designed to be cleaned?

A. Yes, sir.

Q. What is the custom of the management as to the amount of water you carry in the boilers?

A. We have *guage* cocks and also glass *guages*. I did not know the exact height in the glass *guages*, because it varies so much. I have tended water in boilers myself, but not in this kind.

Q. What was the instruction of the management about the water being carried in the boilers? Do they have cocks there to *guage* it?

A. They have valves on the pipes to *guage* it.

Q. Did you carry the water above the top test-cock?

A. Sometimes it gets there.

Q. What do you do then?

A. We blow it off with the blow-off cocks.

Q. To what *guage* did you usually carry your water?

A. We are supposed to carry it to the upper *guage*.

Q. Do you correct it when it gets above the cocks?

A. We have a man there for that purpose. We do not always do it; we cannot always do it, in my opinion.

Q. Then your custom is to carry it as high as the top *guage*?

A. Yes, sir.

Q. Do you do it; and, if not, why not? Is it carried there as regularly as it is ordinarily in boilers?

A. Yes; as it can be in these boilers. When I find a man cannot correct it, then I get another man. I have had no man that can keep it regulated at the proper place.

Q. Why?

A. My opinion is there is not space enough in the boilers to hold the water, and it keep- the men just running from one to another to keep it there if we run three or four batteries.

Q. Is there more or less than three barrels of water between high-water mark and the low *guage* in these boilers?

A. That I cannot say.

Q. Well, about what do you think is the difference?

332 A. I could not say.

Q. Then do you mean that the point above high-water mark is attained so quickly that it takes constant attention to keep it to that point?

A. Yes; the defect in the boiler is this: When you make two or three revolutions it takes the steam out. There is not space enough, and the water raises up or down. The steam is not made fast enough and it keeps raising up and down.

Q. You went on duty with Mr. Chamberlain when he took hold of the furnaces?

A. Yes, sir.

Q. How much scrap iron was there around the two furnaces that had accumulated under the management of Mr. Gordon & Mr. Doud?

A. I would think there was 500 tons.

Q. How do you get at this figure?

A. We generally took an inventory of the iron, sometimes once a week, and made reports to headquarters. I have done a great deal

of estimating that way, and would say that there was 500 or 600 tons at that time.

Q. How much do you think that estimate would vary either way?

A. From 25 to 50 tons either way.

Q. Did you, at any time, make a test by measuring the blast at the engine and at the furnace in running three engines there for the purpose of determining how much blast was lost from the engines to the furnaces?

A. For quite awhile; I do not remember how many months; we had *guages*—one in the engine-house and one at the furnace—and it varied but very little.

Q. What do you mean by very little?

A. There is, naturally, a little loss; a very little amount was lost. One of the *guages* got damaged and we didn't have any for some time. I had one fixed up and tested it, possibly a month ago, and found it working the same way—very little loss.

Q. Then, when you are running these three engines at a 27 to 30 revolutions, practically all the blast that the engine made went into the furnace?

A. The pressure showed so.

333 Q. These are the only instrument- that you can test by, are they not?

A. That's all I know of.

Q. Are they understood to be correct by furnacemen?

A. They are, so far as I have heard.

Q. If I understand that, then, this test registers the blast after it gets in transit to the furnace and show- the leakage, if any, between the point where the blast goes in the pipe and where it comes out—I mean any lost blast in the engines would not be registered in that device?

A. No, sir.

Q. How many furnaces did you ever blow in or assist in blowing in?

A. I have blown in four furnaces I had charge of myself and have assisted in blowing in I do not know how many.

Q. About how many—ten, a dozen, or how many?

A. It was ten, anyway; possibly more.

Q. Was that as assistant foundryman?

A. Yes, sir.

Q. If a furnace is burdened in this proportion when it is burdened first, viz., ore, 8,000 lbs.; coke, 4,500 lbs.; limestone, 3,000 or 3,500 lbs.; if the furnace was loaded that way, fired and commenced blowing it, state what would be the probable result of that blow-in.

A. I would expect it not to blow in if it was started that way. It is my opinion it would be a failure.

Q. Would a lime-set be the result or what would be the result at this furnace, burning these ores?

A. I have not seen any of these ores that I would like to use that much limestone with if the furnace was running regularly. In

the next place, I would not like to have that amount of ore when the furnace was first blown to that amount of coke.

Q. Were the ores when you went there better or worse than they have been since you have been in the management?

A. We have received ores a good deal worse than we had in the first place.

Q. Have you undertaken to carry these burdens in these proportions?

A. No, sir; I have not.

334 Q. Would there be any more danger in producing a lime-set in a furnace in undertaking to carry that much limestone than there would be after the furnace got into operation?

A. Yes, sir.

Q. What was the condition of furnace "B" when Mr. Chamberlain received it from Mr. Doud?

A. It was in a bad condition.

Q. In what respect?

A. It was built up in the bottom and would not hold the amount of iron that it should hold or has held since. You could not get the cinder out of the cinder notch. If you could get it out the iron would come out also.

Q. How often did you have to cast?

A. Every two or three hours or as quick as we could get ready after one cast. The place was so small you could not hold the iron.

Q. Didn't you run there a week before Chamberlain was in charge?

A. I was there from Tuesday until Saturday.

Q. How often did they have to cast at the furnace then?

A. Every two or three or four hours.

Q. You state the condition, as you just have, at the time when Mr. Chamberlain took hold of it. Was that or not its condition during the week preceding?

A. Yes, sir; during the whole of the week.

Cross-examination by Mr. GUNTER:

Q. Don't you vary the amount of ingredients with which you charge a furnace according to the analysis of the ores, coke, and limestone to be used?

A. Yes; if you have an ore that has more silica than others of course it requires more limestone.

Q. What is the rule for varying the limestone and silica to the quantity of each other? You put in lime to flux the silica?

A. Yes, sir.

Q. If you have 20 lbs. of silica, how much limestone do you put in to flux it?

A. It might possibly take 50 lbs.; it might take less.

Q. Then if you have 20 % silica you put in 50 lbs. of lime?

A. It varies at times.

335 Q. When does it not require so much?

A. When you do not need so much.
Q. How can you tell whether it needs more or not?
A. By the slag.
Q. Then you cannot tell at all till you see the slag what it needs?
A. You cannot.
Q. When you are charging a furnace you would have to wait to see the slag to know how to charge it?
A. If I have the analysis of the ores, etc., I might charge it according to the analysis, and might get left on it and might not.
Q. Can you tell me how to charge a furnace when it is first blown in with this analysis? Suppose there is—

| | |
|---|---|
| Pure metallic iron | 45.12 |
| Oxygen with iron | 19.28 |
| Silica | 16.27 |
| Water | 12.24 |
| Alumina | 4.38 |
| Lime carbonate | .19 |
| Magnesia | Trace. |
| Phosphoric acid | 1.945 |
| Sulphuric acid | 0.000 |
| Undetermined and loss | .575 |

This is one ore; the other has—

| | |
|---|---|
| Pure metallic iron | 46.87 |
| Oxygen with iron | 20.9 |
| Silica | 15.30 |
| Water | 10.903 |
| Alumina | 3.657 |
| Lime carbonate | .871 |
| Magnesia carbonate | .282 |
| Phosphoric acid | 1.16 |
| Sulphuric acid | .03 |
| Manganese | .857 |

You are to use these two ores half and half. Your limestone has—

| | | |
|---|---|---|
| | Carbonate of lime | 97.13 |
| | Carbonate of magnesia | 1.05 |
| | Silica | .86 |
| | Oxide of iron | .19 |
| | Alumina | .22 |
| 336 | Phosporus | 0.033 |
| | Undetermined and water | 5.417 |

The analysis of the coke is—

| | |
|---|---|
| Water | 1.17 |
| Carbon | 81.67 |
| Ash | 16.06 |
| Volatile combustible matter | 1.1 |
| Sulphur | 1.36 |

The analysis of the ash of the coke is—

| | |
|---|---|
| Silica | 7.93 |
| Alumina | 3.85 |
| Lime | .194 |
| Manganese | .1 |
| Iron and other ingredients | 2.21 |

A. Not in that way, I can't.

Q. Didn't you just now say that 3,000 to 3,500 lbs. lime to 4,500 lbs. of coke and 8,000 lbs. of ore was an improper charge?

A. I said that I would not charge a furnace that way to blow it in.

Q. What is your opinion as to Mr. Doud's capacity as a furnaceman?

A. I do not know anything about his capacity.

Q. Suppose you had coke with no sulphur and required to take coke that had 2% sulphur in it, if the charge of your furnace was the same in all other respects and you just changed the coke and the only difference in the coke was 2% sulphur in it, what change would you make in the formula of the other ingredients?

A. Put on more limestone.

Q. How much more limestone?

A. That depends upon circumstances.

Q. What circumstances?

A. How the furnace was running the blast, etc.

Q. State what change you would make if the blast was precisely the same as before.

A. I cannot answer that.

Q. If you say you would not charge a furnace with 8,000 lbs. ore, 4,500 lbs. coke, and 3,000 to 3,500 lbs. limestone in blowing in the furnace, how would you charge it?

A. If with these ores, I would not have so much limestone.

Q. How much would you put?

337 A. I would not use more than 25 or 26 % of stone—that is, with the ores we are using.

Q. You say you would not want more than what per cent.?

A. 25 or 26.

Q. To what?

A. To the ore.

Q. Tell the court what per cent. 3,000 is of 8,000.

A. 37½ %.

Q. How do you do that?

A. By dividing the amount of stone by the ore.

Q. You work that by dividing the stone, which is 3,000 lbs., by 8,000 lbs., the ore, and you get 37½ %?

A. That is what it will give you; it will give you 37½ pounds of stone to 100 lbs. of ore.

Q. That is the per cent. of the stone to the ore?

A. Yes.

Q. What coke is it you are working with?

A. Nothing has been said about coke.

Q. Would you not vary with the kind of coke you use?

A. If there is more sulphur in the coke you want more limestone.

Q. Then your rule is just to put 25 or 26 % of lime to the ore?

A. Yes, sir.

Q. Suppose the furnace is running, how much do you put?

A. It might not require so much and might require more; it depends upon the ore; if the furnace is running it might possibly require more.

Q. You say these ores are worse now than they were then?

A. As a general thing they are; one is considerably worse.

Q. They vary, don't they?

A. Yes, sir.

Q. As ores vary—they vary in silica, don't they?

A. Yes, sir.

Q. In running a furnace you vary the limestone according to the variations in the ore?

A. Yes, sir.

Q. If you charge a furnace accurately you have to vary the amount of limestone, don't you?

A. The more silica in the coke it requires more limestone.

Q. Charging a furnace is really a mathematical process, is
338 it not; if there is an absolute formula it is accurate, is it not?

A. Not necessarily; I know a man that don't know *a* from *b* that could charge a furnace accurately.

Q. A man that don't know *a* from *b* might run them just as well?

A. Yes; if he knew how.

Q. Knowing the analysis would not hurt it?

A. No.

Q. Can you run a furnace with safety and certainty without knowing the analysis?

A. It has been done.

Q. Is knowing the analysis any aid in running them?

A. It is; but it can be done without it; it is not necessary information at all; it is well enough to know it, but men have run furnaces without, and men have made sad mistakes by knowing it.

Q. And men have made sad mistakes by knowing it, have they?

A. Yes; they make them if they don't know it and if they do.

Q. How does your Jasper coke compare with the Pocahontas coke in any respect?

A. There is more sulphur in the Jasper coke than in the Pocahontas coke.

Q. How do you know it?

A. I tell it by working in the furnace.

Q. How can you tell it?

A. You smell it and inhale it.

Q. Can you tell the smell of sulphur that comes from coke?

A. I can tell if there is more or less by inhaling it; you can tell sulphur on coke by seeing it.

Q. Can you tell the per cent.?

A. No, sir.

Q. To take it out don't you have to know the per cent.?

A. Not necessarily.

Q. Why not necessarily? Don't you have to guess at it?

A. If I have five pounds of stone on and need five more I put it on.

Q. If you don't know how much sulphur there is, don't you have to guess at it? Isn't it guess-work by putting on the stone, anyway?

A. No, sir.

Q. How can you tell?

A. I can tell it by the slag; I generally get there.

Q. You tell by the slag?

A. Yes; that's no guess-work.

339 Q. Until you get the slag, what do you go by?

A. I put stone in the furnace until I get slag.

Q. It is guess-work until you get a slag?

A. I can't tell exactly until I get a slag.

Q. If you know the analysis of the ores and all the contents that go into the furnace, you could not tell then exactly how much to put in?

A. I could not.

Q. You say you had a *guage* at the engine-house on the blast main?

A. Yes, sir.

Q. And you had another *guage* on at the furnace?

A. Yes.

Q. These two *guages* simply registered the pressure at these two points?

A. Yes, sir.

Q. Well, now, would it not be possible for these two *guages* to register the same pressure or approximately the same pressure at these two points and for no blast to go into the furnace?

A. It would be if the tuyeres were shut up.

Q. It is possible, then?

A. It would not be possible if the furnace was in working order unless the tuyeres were shut up.

Q. Isn't it possible for this pressure to exist and yet for no blast to go into the furnace?

A. If the tuyeres were shut up it could not get in.

Q. Suppose the pressure indicated on the blast main at the engine-house was one thing, say seven pounds; now, suppose between the engine-house *guage* and the *guage* at the furnace there were waste places all along and the condition of the furnace was such as to make it difficult for the air to circulate through the materials, could not the blast show a pressure at both places approximately the same and yet very little blast actually go into the furnace, owing to this waste between?

A. It would make no difference on the pressure.

Q. The pressure upon the blast don't indicate the volume of air that actually goes in?

A. No, sir.

340 Q. The pressure is only an indication of the difficulty of pushing the blast in?

A. That is all.

Q. But the actual quantity of the blast is determined by the revolutions of the engine?

A. Yes, sir.

Q. A given number of revolutions would give you, everything being in order, the same volume at 4½ lbs. pressure as would be given with the same revolutions as ten pounds pressure?

A. The same volume of air.

Q. For iron-making and for combustion there is a certain amount of air required?

A. Yes; it is volume, not pressure.

Q. So it is the revolutions of the engine and not the pressure that determines the necessary quantity to be given to the furnace?

A. Yes, sir.

Q. Two furnaces side by side, making about the same quantity of iron, one with a pressure of 4½ to 5 pounds and the other with nine pounds, what would you say caused the difference?

A. It might be a difference in the furnace or a difference in the materials used or both.

Q. Think it would be a difference in the plant?

A. If the two furnaces were the same and the materials were the same, then I cannot say what would be the cause.

341 GORDON, STROBEL & LAUREAU
*vs.*
S. & B. C., I. & R'Y CO.

*Testimony of Partlow & J. H. Murphy.*

EXHIBIT "B," PARTLOW-MURPHY. Filed in clerk's office July 19th, 1890. A. W. McCullough, clerk.

342 Interrogatories in the petition and intervention of Gordon, Strobel & Laureau *vs.* Sheffield & Birmingham Coal, Iron & Railway Co., taken before the master in chancery, Hon. D. D. Shelby, at Huntsville, Ala., September 20th, 1889.

JAMES H. PARTLOW sworn for respondents.

By Mr. WHITE:

Q. What is your occupation?

A. I am an engineer?

Q. Where at?

A. I am now foundry boss for the Sheffield & Birmingham Coal, Iron & R'y Co.

Q. You have been an engineer?

A. Yes, sir.

Q. Where at?

A. I ran the engine there when they first blew in for a weeks.

Q. You know about the lead on these engines. Who put them there?

A. I do not know what lead they have now; I am not connected with them.

Q. Who put the lead on them when you were engineer?

A. Mr. Gordon.

Q. Did you run those engines under Mr. Dowd?

A. Yes, sir.

Q. Were the leads changed?

A. Yes, sir.

Q. And run under the leads of Mr. Dowd?

A. Yes, sir.

Q. Were they changed again?

A. Yes, sir; after Mr. McIlwaine took charge.

Q. Did Mr. Gordon have this work done under his supervision?

A. He changed one or two himself and I helped him on one or two.

Q. What practical experience have you had with engines? How long have you been at it?

A. Off and on for eighteen years.

Q. Ever served an apprenticeship?

A. No, sir.

Q. How did you gain your knowledge; ever been to school?

A. Yes; but never studied engineering at school, but
343 learned under a practical engineer.

Q. How many engines were used in the operation of one furnace?

A. We used two and sometimes three; have used three for the past three months.

Q. Why did you use three instead of two?

A. To get power to operate the furnaces.

Q. At how many revolutions did you run these engines when running three?

A. From 27 to 35 each.

Q. Can these engines be run safely when two are in operation with ten pounds of pressure up as high as 48 strokes per minute?

A. I am hardly able to say. They have not stood that test in working up to that speed.

Q. Why do you use three instead of two? Would not two do the work if you could get sufficient speed?

A. We use three to make the work easier on the engines.

Q. You have never seen two operate up to that capacity?

A. No, sir.

Q. What boiler power do they use when operating three?

A. Two and one-half to three batteries; sometimes four.

Q. Do you know why they use three instead of two?

A. To get more steam.

Q. But why do you want more steam?

A. Because two batteries do not furnish sufficient steam.

Q. What is done when the gas gets to burning at the top of the stacks?

A. We cannot do anything; just have to let it burn.

Q. It is not intended to burn there, is it?

A. No, sir.

Q. Has not an effort been made to correct that?

A. There have been efforts time and again among the men in charge.

Q. Are there not valves in front and valves behind to prevent that?

A. Yes, sir.

Q. Are they used to correct that when it happens?

344 A. It is not necessary to use the one behind.

Q. Do you use any of them?

A. No, sir; to stop it from burning at the top we would have to shut the gas off. We cannot do anything; have not, so far, succeeded in stopping it with the valves.

Q. Why does it not burn there all the time?

A. Because at sometimes the furnace makes more gas than at others.

Q. How many times has that occurred?

A. A great many, more or lsss. When the furnace is working well, the gas burns at the top of the stacks.

Q. You were there when the furnace was first blown in?

A. Yes, sir.

Q. Did you or not have any trouble with the steam valves, pipes, and joints?

A. We did not have any trouble with the steam valves. We had some trouble with the leaky joints.

Q. Have they been corrected since?

A. Yes, sir.

Q. Who did it?

A. It was done after Mr. McIlwaine took charge.

Q. Will two of these boilers supply sufficient steam to run one furnace with two engines?

A. I do not think they will; they have not done so since I have been there.

Q. Will they ever do it?

A. I am not able to say; they have not done it yet.

JAS. H. PARTLOW.

345 JAS. MURPHEY sworn for respondents.

By Mr. WHITE:

Q. What are you, Mr. Murphey?

A. An engineer.

Q. Where at?

A. At the Sheffield & Birmingham Coal, Iron & R'y Co. furnaces.

Q. How long have you been there?

A. Twelve months, but have not been running the engine that length of time.

Q. What experience have you had in running engines?

A. Five years.

Q. Where at?

A. In Tennessee; mostly with blast engines.

A. I do not know what lead they have now; I am not connected with them.

Q. Who put the lead on them when you were engineer?

A. Mr. Gordon.

Q. Did you run those engines under Mr. Dowd?

A. Yes, sir.

Q. Were the leads changed?

A. Yes, sir.

Q. And run under the leads of Mr. Dowd?

A. Yes, sir.

Q. Were they changed again?

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Q. Did Mr. Gordon have this work done under his supervision?

A. He changed one or two himself and I helped him on one or two.

Q. What practical experience have you had with engines? How long have you been at it?

A. Off and on for eighteen years.

Q. Ever served an apprenticeship?

A. No, sir.

Q. How did you gain your knowledge; ever been to school?

A. Yes; but never studied engineering at school, but
343 learned under a practical engineer.

Q. How many engines were used in the operation of one furnace?

A. We used two and sometimes three; have used three for the past three months.

Q. Why did you use three instead of two?

A. To get power to operate the furnaces.

Q. At how many revolutions did you run these engines when running three?

A. From 27 to 35 each.

Q. Can these engines be run safely when two are in operation with ten pounds of pressure up as high as 48 strokes per minute?

A. I am hardly able to say. They have not stood that test in working up to that speed.

Q. Why do you use three instead of two? Would not two do the work if you could get sufficient speed?

A. We use three to make the work easier on the engines.

Q. You have never seen two operate up to that capacity?

A. No, sir.

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Q. But why do you want more steam?

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A. No, sir.

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A. There have been efforts time and again among the men in charge.

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A. Yes, sir.

Q. Are they used to correct that when it happens?

344 A. It is not necessary to use the one behind.

Q. Do you use any of them?

A. No, sir; to stop it from burning at the top we would have to shut the gas off. We cannot do anything; have not, so far, succeeded in stopping it with the valves.

Q. Why does it not burn there all the time?

A. Because at sometimes the furnace makes more gas than at others.

Q. How many times has that occurred?

A. A great many, more or lsss. When the furnace is working well, the gas burns at the top of the stacks.

Q. You were there when the furnace was first blown in?

A. Yes, sir.

Q. Did you or not have any trouble with the steam valves, pipes, and joints?

A. We did not have any trouble with the steam valves. We had some trouble with the leaky joints.

Q. Have they been corrected since?

A. Yes, sir.

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A. I do not think they will; they have not done so since I have been there.

Q. Will they ever do it?

A. I am not able to say; they have not done it yet.

JAS. H. PARTLOW.

345 JAS. MURPHEY sworn for respondents.

By Mr. WHITE:

Q. What are you, Mr. Murphey?

A. An engineer.

Q. Where at?

A. At the Sheffield & Birmingham Coal, Iron & R'y Co. furnaces.

Q. How long have you been there?

A. Twelve months, but have not been running the engine that length of time.

Q. What experience have you had in running engines?

A. Five years.

Q. Where at?

A. In Tennessee; mostly with blast engines.

Q. Were you in charge of the engine when the bed plate broke?
A. I was in charge of number six.
Q. Was the engine working regularly?
A. Yes, sir; she was running 30½ revolutions.
Q. What caused the break?
A. I cannot tell, unless it was weak iron or something in the foundation.
Q. Had the waste-cock at the bottom of the cylinder been attended to?
A. Yes, sir. I was always particular about that.
Q. Did that one receive that attention?
A. Yes, sir.
Q. Was there any apparent cause or misaction of the machinery?
A. No, sir. I was right there and had my foot against the bed plate when it broke.
Q. Was there any perceptible irregularity in the working of the engine when it broke?
A. If there was I did not know it.
Q. Could there have been any water in the cylinder at that time?
A. I do not think there could, and her running smoothly.
Q. If there had been any water it would have produced an irregular working so that you would have detected it?
A. I suppose it would.
346 Q. How many engines are used in operating that furnace?
A. We have run from two *and* four; three most of the time.
Q. What part of the time have you run two?
A. A very little?
Q. Why did you run only two?
A. We were trying to see if we could get the pressure from two that was necessary.
Q. What boiler power did you use?
A. Three batteries mostly.
Q. Why did you use more than two?
A. Because two did not give sufficient steam.
Q. Why did they not?
A. Because they were not big enough; not enough of them.
Q. Were these engines of sufficient strength to operate the furnace with two of them, using 8 or 10 pounds pressure and attaining a stroke *if* 45 or 48 revolutions?
A. I could not say; have not seen them tried.
Q. Do you or not think that two or three batteries of boilers would get up sufficient steam to run these two engines so that the blast pressure would be ten pounds?
A. I do not believe they will do it.
Q. Were you operating the engines when the b[illegible]last cylinder was broken?
A. Yes, sir.
Q. Do you know what caused that?
A. No, sir; unless it was a bad piston.
Q. Did you examine it when it was t[illegible]aken out?
A. Yes, sir.

Q. What did you think was the matter with it?
A. I found sand-holes in piston head with Babbitt metal poured in the sand-holes.

J. H. MURPHEY.

347 *Deposition of Fred. Massey. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

(Copy.)

348 FRIDAY, *September 20th*, 1889.

FRED. MASSEY sworn for respondents.

By Mr. WHITE:

Q. What is your vocation or profession?
A. I am a machinist.
Q. What has been your experience in that business?
A. In blowing engines I have not had a great deal; in other engines I have had about 35 years.
Q. In what kind of steam machinery?
A. In all kinds of engines; in fact, high and low pressure.
Q. You are a practical engineer?
A. Yes, sir.
Q. Did you serve an apprenticeship?
A. Yes, sir; mostly in London.
Q. What employment are you engaged in now?
A. I am master mechanic at the furnaces of the Sheffield & Birmingham Coal, Iron & R'y Co.
Q. What do the duties of that position involve?
A. The whole machinery is in my care to take charge of and keep in order.
Q. Then you are acquainted with the engines and boilers at these Cole furnaces?
A. Yes, sir; thoroughly.
Q. What number of engines does it take to do the work of one furnace?
A. We can work it with from two to four.
Q. What boiler power do you use when working two engines?
A. Never less than six; sometimes seven and eight; have used as many as ten. We used ten week before last.
Q. How many batteries were designed to run two engines?
A. I presume two.
Q. What is the smallest number of boilers that you have ever undertaken to run one furnace with two engines?
A. Three batteries of these boilers.
Q. Have you ever tried it with less boiler power?
A. Yes, sir; we have had occasion to slow down on account
349 of repairs; to get another boiler started up.
Q. Are two engines operated by two batteries of boilers sufficient to operate one furnace or not?

A. I could not tell; I am not a furnaceman; but with two batteries of boilers on two engines we could hardly turn them over at all.

Q. Would two batteries of boilers be sufficient to operate two engines with eight pounds pressure?

A. No, sir.

Q. Why can't you operate two engines with two batteries of boilers?

A. I do not think the boilers are large enough; they have not got the capacity; in fact we cannot make the steam; the arrangement for the gas is bad and we lose a good deal of it.

Q. If I understand your answer it is that the boiler power is insufficient the way it is arranged.

A. Yes, sir.

Q. What number of engines have you been using there usually?

A. Always used three.

Q. At what speed do you run these engines?

A. We run three engines from 27 to 35, endeavoring to get a pressure of nine pounds, but could not do it only once or twice; very rarely and at short intervals.

Q. To what speed can these engines be run with safety?

A. That would depend a good deal upon the blast pressure.

Q. With the average pressure that you used?

A. I would not like to run them over 35 or 40 with the three engines—with any engine, in fact.

Q. Is it safe or not to run these engines with 40 revolutions with ten pounds pressure?

A. I do not think they would stand it.

Q. Would it be safe to operate these two engines to 40 revolutions with ten pounds pressure?

A. No, sir.

Q. What would be the result?

A. They would pull themselves down.

Q. Why?

A. I think the housen would break in the middle and the engines are put on soft red-brick foundations, with iron bolting *corking* on the bottom of them; there are four foundation bolts, one on each corner; but that would make no difference if the bed plates were heavy enough; but they are not with the foundations they have; one engine has broken on a down stroke and another on the up stroke.

Q. You say that the bed-plates of the two engines have broken?

A. Yes, sir.

Q. What will it cost to put in a new plate in each engine?

A. I suppose not less than $1,500 to an engine, from the fact that when they built the engine-room they did not put the proper appliances on the top to remove any part of the engines; there should have been a tramway run across the building from the top of each engine.

Q. Do you mean that it necessitates taking down the engine to repair it?

A. Yes, sir.

Q. What is the cost of taking an engine down in the fix these are over there?

A. I do not think it can be done for less than $1,000 to $1,500.

Q. Do you mean that it would include the cost of the plate.

A. No, indeed; just taking the engine down and re-erecting it.

Q. Will the bed plates spring when run at 35 revolutions?

A. Yes, sir.

Q. You say one was broken on the down stroke and one on the up stroke?

A. One was broken underneath the pedestal and the other from the top on the front, showing a fracture from the bottom to the front, diagonally coming up.

Q. Does the character of the breaks determine you in your opinion that one was broken from the upward stroke and the other from the down?

A. Yes; I think so.

Q. If there had been four more holding bolts, would that result have been likely?

A. It may have sustained some, but I think the housens too light for the power applied in blowing them.

351 Q. Has there been a break in the plates in the blowing cylinder?

A. Yes; the housen plates in three engines are broken, I think.

Q. What caused the break?

A. Too light.

Q. When did it occur?

A. At intervals; two while I was there and two while Mr. Stevenson was there; all about the same way.

Q. When did you go there?

A. I have been there between three and four months; went the first of July.

Q. How has that machinery been handled since you have been there; carefully or recklessly?

A. I think carefully.

Q. What is the character of the men working there? Have they capacity or are they negligent?

A. So far as my department goes, I think they are men of capacity and experience. Some of them have been at the business since their youth.

Q. If all these breakings have occur-ed by running three engines to one furnace, what would have been the probable result of running only two engines to a furnace?

A. I think it would have been simply impracticable. I do not think we could have done anything with two.

Q. What would have been the result of running two engines with sufficient pressure?

A. I believe it would have turned the engine over. It would be necessary to get a new engineer at every shift.

Q. You think, then, that there would have been danger enough to kill a man?

A. Yes, sir; I think so.

Q. Are you acquainted with the system of steam pipes, water pipes, and valves that have been put in there since the furnaces have been erected?

A. Yes, sir.

Q. In your opinion, were these necessary in order to insure the working capacity of the machinery?

A. Yes, sir; and there is not half enough yet.

Q. Have you noticed any patching around the steam joints in these engines?

A. Yes, sir; there is a patch on the side of the pipe of number one engine.

352 Q. Do you know what causes necessitated that patch being put there?

A. It was defective when put up.

Q. Has it given you any trouble by leaking?

A. It is leaking now very badly. We cannot possibly correct it.

(It is agreed and understood that all legal objection is taken to this testimony offered by defendants.)

Cross-examination by Mr. GUNTER:

Q. When did you leave those furnaces?

A. Yesterday at three o'clock.

Q. Your furnace is not running now?

A. No, sir.

Q. Chilled, is it not?

A. Yes, sir.

Q. What is the size of these engines?

A. 36 x 4 ft. steam ends and, I think, 8 x 4 feet blowing cylinder. I have never measured them and do not know the exact size.

Q. Were you ever over at the Lady Ensley furnaces?

A. No.

Q. Do not know the size of those engines?

A. No.

Q. Will you explain how a bed plate could be broken by running an engine?

A. There could be several occasions. You could draw an engine out by starting out with the cylinder full of water.

Q. The lower part of a cylinder of a vertical engine gets full of water and then, by starting off suddenly, the down stroke of the engine, striking this water, does what?

A. It would break the bed plate.

Q. How will the down stroke of an engine, striking water in the bottom of an upright cylinder, break the bed plate, which is under that cylinder?

A. Because it has to make the stroke. The engine is connected with rods from the cross-head to the main shaft and the engine would have to make the full stroke of four feet or whatever stroke the engine might be, and, in consequence the water was in there,

something should be apt to break, either the bed plate or some other part of the machinery.

Q. You say that is one way in which the bed plate could be broken. Please state any other way in which the bed plate could be broken.

353 A. It could be broken by defective foundations the way these were broken.

Q. To break the bed plate it has to receive a lick, does it not?

A. It has to receive continued licks. If there is any space between the bed plate and the foundation it is bound to go, sooner or later.

Q. It has got to be broken by licks or continued licks?

A. Yes, sir.

Q. Now, state how it would receive blows.

A. By the necessary working of the engine.

Q. You say the necessary working of the engine?

A. Yes, sir.

Q. You say that one way is that water gets into the lower end of the cylinder?

A. Yes, sir.

Q. And another way is?

A. I don't know any other way outside of general usage.

Q. Now, as a machinist, don't you know that if an engine has no lead on it and no water for the piston head to strike against before it makes it- full stroke—an engine running that way—that it makes no strain upon the bed plate beyond its mere weight?

A. Yes, sir.

Q. That's so?

A. Unless you run the engine just for fun.

Q. As a machinist, don't you know that the power developed by running an engine depends entirely upon the pressure of steam which is put in first on one side of the piston follower and then on the other side?

A. Yes, sir.

Q. Now, answer me this question: If you put steam enough on one side of the piston follower to run the engine for fun and it produces no blow, how is it that an increase of pressure in the same way would make a blow? When would it make a blow?

A. As the pressure increases on the blow-tube you have more increase of steam, and that produces a pressure on the two cylinder heads, one down and one up, and that is where the blow comes when working—the reaction of one upon the other.

Q. When the steam comes in on top of the steam piston

354 and pushes it down the piston in the blowing cylinder is pressing on air, but if the steam pressure is greater than the pressure on the air, is not the effect of that merely to cancel that much steam pressure?

A. No, sir; she simply makes more revolutions and you have to shut her down. Whenever she works easily, of course, you have to give her less steam.

Q. If they are exactly equal would the engine move?

A. No, sir.

Q. The one represents a pressure of 80 lbs. and another of 100 lbs.; the actual effective pressure is 20 lbs. to move the engine?

A. Yes; it will take about 20 pounds to turn the engine over.

Q. Then the air pressure that has to be pushed out of the way of the descending piston simply requires a greater steam pressure to exceed the quantity of steam pressure in the cylinder below?

A. Yes, sir.

Q. Do you mean to say that the blows in the blast cylinder in running an engine must result from something—being either water or steam—being in the cylinder and the piston coming against it?

A. Yes; or a defect in putting the machinery down in the foundation.

Q. Then the only risk to the bed plate is something in the way of a cushion in the cylinder meeting the stroke of the cylinder as it comes one way or the other?

A. The only reason for parting, if the foundations were solid, would be weakness of the bed plate or housen.

Q. How can an engine strike its bed plates and the foundations be proper?

A. The piston could not strike the bed plate at all.

Q. It could transmit a lick, couldn't it?

A. No; it could not.

Q. The piston, descending and hitting the cushion of water, could not transmit a stroke to the bed plate?

A. I say yes; the piston head in the cylinder could, in descending, strike a direct blow against the cylinder; it could strike on the up stroke but not on the down.

Q. The cylinder is directly over the bed plate?

A. Yes, sir.

Q. If the piston is coming down at a rapid rate and water or steam is in the bottom of the cylinder and the cylinder striking that suddenly, is not the effect of this blow to transmit its
355 effect in the same direction the piston was going?

A. It would be; yes.

Q. Would not that come directly in contact an- conflict with the bed plate?

A. Yes, sir.

Q. Then on the down stroke of the piston against the cushion of water a blow would be transmitted to the bed plate?

A. Yes, sir.

Q. Didn't you just say that it could not?

A. No; the trouble we have had is the breaking of the heads on the up stroke.

Q. You say the bed plate was broken in one instance on the up stroke?

A. Yes, sir.

Q. You say the up stroke was broken by what?

A. Simply because the foundation was defective. It played back and forth and the foundation was not strong enough.

Q. What made it break?

A. I cannot tell what made it break.
Q. There is a cylinder head broken of one?
A. Yes, sir.
Q. What did that?
A. Defect in the erection of the machinery.
Q. The steam coming in at the bottom of the steam cylinder, you say a bolt in that piston on top of the head came out?
A. Yes, sir.
Q. And as the piston ran up it hit against the head of the cylinder and knocked the head out or broke it?
A. It made the break. It broke the follower first, then the cylinder head, and then the cylinder.
Q. It did not break the cylinder head?
A. Not in that case.
Q. But the effect of that blow was very severe?
A. Yes, sir; yes, sir; it shook the whole engine-room.
Q. But did not break the bed plate?
A. No, sir.
Q. If it had been a very weak bed plate it would have broken, would it not?
A. Not necessarily.
Q. A very severe percussive blow that would shake the engine-room would not necessarily break a weak bed plate?
A. Yes; it would; but in that case the cylinder head let go first and broke first.
356 Q. You say those bolts came out on top of the piston head?
A. It was a T bolt. It could turn around by not having the bolt in it and get on top of the cylinder head and follower head and break it.
Q. Do you know whether these bolts had been taken out at any time after the engines were erected?
A. Yes; they have to be necessarily taken out and set back.
Q. You don't know how they were put in when the engine was first erected, do you?
A. No, sir.
Q. If they had been taken out and put back by competent machinists they would have been put back with a block, would they not?
A. Yes, sir.
Q. And the want of that block caused that disaster that you have just referred to?
A. Yes, sir. This disaster happened when I was there, about six weeks ago.
Q. You know the bolts that hold down the caps on the top of the main shaft?
A. Yes, sir.
Q. Do you know the size of those bolts?
A. 1¼ in.
Q. How many of them?
A. Four.

Q. Four on each side?

A. No; two on each side. By having two caps, of course there will be eight.

Q. Some of these bolts broke?

A. Yes, sir.

Q. These breakages were caused necessarily by the lifting of the shaft?

A. Yes; I should suppose so; they were.

Q. And if the engine was run properly by a proper machinist, with a proper lead on it, there would be enough force to lift the shaft, wouldn't there?

A. If the engine was properly constructed, no.

Q. Show where the improper construction would lift the shaft.

A. The shaft would be lifted from the fact that the engine would have too much lead.

Q. Have I not just told you that the supposition was that there was no lead?

A. Nothing of the kind.

357 Q. If there was no lead to an engine and no cushion for it to strike against in up-going or descending, would there be anything to lift the main shaft?

A. Why, certainly not.

Q. Then that breakage in these bolts must have been caused by something in the way of a cushion or improper lead?

A. Yes.

Q. The foundations being all right and there being no lead or cushion, would there be any tendency to vibrate the bed plate up or down?

A. No; I do not think there would be.

Q. If the duty on an engine is at a certain pressure, say four to five pounds of blast, might you not put a lead on that kind of blast or pressure which would be improper upon a much higher blast or pressure?

A. No, sir; I think not.

Q. You then think that no lead ought, in any case, to be on an engine, no matter what duty it has to perform?

A. I do not think anything of the kind.

Q. Well, then, if you do not change the lead when you double the duty, when do you change it?

A. Do not change it at all.

Q. Then, you must have the same lead for every duty?

A. Exactly.

Q. That's your opinion as a machinist?

A. Yes, sir.

Q. Do you get a lead to an ordinary engine, say run[illegible]ning a saw-mill, where there is no compressed air to counteract th[illegible]e stroke of the piston from the steam?

A. If the engine works one way you alw[illegible]ays get a little lead; I usually use my own judgment.

Q. There is no uniformity?

A. No, sir.

Q. None in your practice?
A. None in any engine.
Q. What rule do you go by?
A. None in particular.
Q. Is not there a difference between engines running a blast and others in reference to the lead?
A. It depends upon the position of the engines; vertical engines should have sufficient lead to relieve them from the concussion of the blow; if I get $\frac{1}{8}$ at top I give them $\frac{3}{8}$ at the bottom.
358 Q. There is no instrument to determine what that lead should be?
A. Yes; there are, but we haven't any. That's not my part of the business.
Q. Why?
A. Simply because I have not the money with which to buy one.
Q. All these things can be determined by science?
A. Yes.
Q. Do you believe in science?
A. I believe in science and practice going together.
Q. They never conflict, do they?
A. No, sir; I don't see how they could.
Q. You say you do not know anything about the employees except in your own department?
A. No, sir.
Q. You do not know what's the blast pressure in running a blast furnace?
A. I do not know anything about it. I am not a furnaceman.
Q. The lead that you referred to is very easily altered, is it not?
A. Yes, sir; too easily altered.
Q. It is done by simply screwing some things that are joined together?
A. Yes, sir.
Q. If they are allowed to screw these down, they might produce concussion?
A. Yes, sir.
Q. That is, is it not, that the party running that character of engine requires constant experience and unremitting care, and that the man is fully acquainted with the full power and scope of machinery?
A. Yes, sir.
Q. And a blockhead or ignoramus would soon ruin the best machinery?
A. That's what he would.
Q. You do not know the condition of that machinery prior to the time you went there?
A. No, sir.
Q. Is this the first blast furnace you were ever connected with?
A. Yes, sir; I went there in May as engineer for five or six weeks, and then Mr. Chamberlain promoted me to master mechanic. I had a number of good references for it.

Q. You do not think that two batteries of these boilers
359 would run two of these engines at a high enough speed to carry on one furnace?

A. No, sir.

Q. Do you know what duty ought to be performed by two engines to run one furnace?

A. No, sir.

Q. Do you know the heating surface of these boilers?

A. No, sir; I never figured it.

Q. You never attempted to figure it?

A. No, sir.

Q. What's the difficulty in figuring the heating surface of these boilers?

A. You would have to measure the diameter of every flue in it.

Q. To get the heating surface you would simply have to measure the area of the heated surface?

A. Yes, sir; and I don't know what that is.

Q. The capacity of the boiler depends upon its heating surface?

A. Entirely.

Q. What pressure of steam do you have in these boilers?

A. About 80 lbs. That's the greatest amount we can carry. We use from 40 to 45 lbs.

Q. You say that the arrangement for gas is bad and that you do not get it all?

A. Yes, sir.

Q. How?

A. The boilers are not constructed to make the best use of it. We sometimes have the gas passing right through the boilers and burning on the top of the stacks.

Q. You desire it all to be burned underneath?

A. Yes, sir.

Q. When is it you have it burning on top of the stacks?

A. At intervals.

Q. Do you know what occasions it?

A. No, sir.

Q. But you know that sometimes it does and sometimes it does not?

A. Yes, sir.

Q. Have you seen the engines pumping over water from the boilers?

A. Yes, sir.

Q. Where did they get the water?

A. From the boilers.

Q. How do you know it is pumping water?

360 A. We see it in the exhaust. That's the way she works water through the engines, and the steam is too wet and keeps the packing loose nearly all of the time.

Q. You say you have not got half enough valves yet?

A. We have not got valves enough in the water supply to the boilers.

Q. It was so arranged originally that if any one of these sets of pipes got out of order the other pumps could run the machinery?
A. Yes, sir.
Q. And it was so arranged that if any of these pipes got out of order any one of them could be shut off and repaired without interfering with the others?
A. Yes, sir.
Q. Could you not shut off any of the boilers at one time?
A. No, sir.
Q. Could you not turn off the valve between the boilers and the steam pipe at any time?
A. Yes, sir.
Q. Could you not shut off any of these boilers at any time?
A. No, sir; sometimes the valves were leaking badly and we could not do anything with them.
Q. With good valves you could have shut off any of the boilers from the main pipe?
A. Yes, sir.
Q. You are a machinist, you say?
A. Yes, sir.
Q. Do you know how the joints are made in that steam pipe?
A. Yes, sir.
Q. They are what is called the flange joints?
A. Yes, sir.
Q. There are 8 or 10 bolts in the flanges?
A. Yes, sir.
Q. How long would it take a skillful machinist, having two monkey-wrenches and plenty of help, to unscrew these bolts?
A. It would depend upon the condition of the bolts. I have worked around one a whole day and might have to cut them off.
Q. Suppose they would unscrew, how long would it take a skillful machinist to unscrew them?
A. About half an hour.
Q. How long would it take you to cut them off?
A. About an hour.
Q. With the packing and bolts at hand it would ordinarily
361 take how long to unscrew these eight bolts, open that joint, and put in new packing?
A. About an hour and a half to each joint.
Q. Would it take that long with plenty of assistance?
A. Yes, sir.
Q. They are the best joints made?
A. I think they are.
A. [illegible] joints of that sort, well made and protected and covered, are not likely to get out of order?
Q. Flange [illegible] are apt to.
A. Yes, sir; they
Q. How, then?
A. It would be impo[illegible]ssible to tell. It would depend upon the [illegible]e joints.
material used in making t[illegible] they would not likely get out of order?
Q. With the best packing [illegible]g and covering.
A. Not with the best packin[illegible]

Q. Do you know the weight of these engines?
A. No, sir.
Q. You say you do not know the size of the Ensley engines?
A. No, sir.
Q. Do you know how they operate?
A. Yes. They do excellent work. I have heard of no complaint.

By Mr. WHITE:

Q. Are these the same engines?
A. No, sir; they lack a lot of it.
Q. How often have you seen gas burning at the top of the furnaces?
A. I do not know exactly: a good many times.
Q. What do they do to remedy it?
A. They have tried everything.
Q. Do they allow it to remain there burning?
A. They fight it until daylight.
Q. They correct it as far as they can?
A. Yes, sir.
Q. The gas is used as a fuel under the boilers?
A. Yes.
Q. They supplement that by the use of coal?
A. Yes, sir; five or six cars a day.
Q. The intention was that the gas would supply the fuel?
A. Yes, sir; it ought to supply nine-tenths of it.
Q. With the gas that you do get and the coal that you do use you do make steam enough to run two engines?
362 A. Yes, sir; by the use of about eight boilers.
Q. When you get the engines in operation can't you run these two engines with ten pounds at a 48 stroke?
A. No, sir; I could not do it.
Q. What do you mean by the lead or machinery?
A. The lead is where the engine takes her steam before she has completed her stroke or her travel, that's all.
Q. What's a cushion?
A. It is steam admitted into the lower part of a cylinder as the piston head descends before she has got to the end of the stroke.
Q. Then, if there is no lead and no cushion formed in the cylinder what will be the effect of the engine on the shaft?
A. It would not be any.
Q. If there was no lead on the engine and no cushion formed, where would it be necessary to bolt the *the* engine down?
A. I do not think it would be necessary if the engine was heavy enough to *g*old itself.
Q. Those appliances have to be used to resist th[illegible]e concussion that necessarily exists in the operation of machiner[illegible]?
A. Yes, sir.
Q. If there was no jar or concussion ca[illegible]sed by no water cushion there would be no use blowing it out, w[illegible]uld there?
A. None at all.

Q. What appliances is in that portion of the machinery at the bottom of the cylinder?

A. A 2¾-in. draw-cock.

Q. When that's properly adjusted that water cushion cannot form in there, can it?

A. No, sir.

Q. In speaking of that cylinder head that was broken, you say it was the result of that T bolt coming out of place, and you further say that it was sufficient to have broken a weak plate. If the cylinder head was weaker it would break that?

A. Yes, sir.

Q. You say that a cylinder head can be broken by a stroke or by being on an unlevel foundation?

A. The plate of an engine can be propped upon four corners and left in the middle, and the pressure would break it.

363 Q. Might not this bed plate have been broken by reason of the fact that it was not on a level foundation? Was not the concussion on the bed plate by the operation of machinery sufficient to have broken it?

A. Yes, sir.

Q. Then, in your opinion, is it just as likely that that break occurred from that reason as from the fact that there may have been an air cushion in the lower part of the machinery?

A. I think it was broken from the fact that the foundation had left the bed plate. The bed plate was resting only on four corners. This applies to No. 2 engine only.

Q. Was that foundation as it was originally constructed?

A. Yes, sir.

Q. What broke the other bed plates?

A. Simply the four corners had broken down, pressing against the bed plates in the centre.

By Mr. BRICKELL:

Q. How far apart are these engines?

A. I suppose 65 or 70 feet.

By Mr. WHITE:

Q. If that bed plate had been constructed strongly — resisted the *the* vibrations of the machinery itself upon the foundation that it was on?

A. Yes, if the foundations were strong enough.

Q. Was that bed plate commensurate with the engine?

A. No sir; if it was it would not have broken.

Q. Who put the lead on that engine—that is, on there?

A. It was already on when I went there, and I let it stay.

Q. Has that lead caused any damage to that machinery?

A. I don't think it was really. I think sometimes there would be an unnecessary amount of lead from the fact that the piston would work down on the steam and get more lead than was intended. I do not think that the lead had so much to do with the

breaking of the bed plates. The cushion in the cylinder with that amount of lead would tend to break the bed plates.

364 By Mr. GUNTER:

Q. Do you know the effect of oil cement on lime?
A. I do not.
Q. What effect has oil on burnt clay?
A. It has a tendency to soften it—it does do it.
Q. Does it dissolve clay?
A. It makes it soft.
Q. How does it do it?
A. The oil going through it, it soaks the oil up.

FRED. MASSEY.

365 *Rebuttal Testimony of Fred. Massey. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

366 FRED. MASSEY recalled for respondents.

Direct examination by Mr. WHITE:

Q. You are a machinist at these furnaces?
A. Yes, sir.

(Witness exhibits some valves.)

Q. The valves that you exhibit were originally in the engine and you altered them?
A. Yes, sir.
Q. What were the defects, if any, in the valves at the start?
A. The defects in the blast valves was that the weight of the valve produced an unnecessary pressure on the engines on account of the lift and weight of the valves.
Q. What was the defect when they shrunk?
A. We took the brass valve out and replaced it with the other cage and used the leather valve and found the valve seat was not large enough to allow for shrinkage of the leather. We enlarged these seats $\frac{1}{8}$ in., using the same valve with a No. 20 iron top.
Q. Which valves did you say were in the engines originally?
A. The brass valves.
Q. You say they caused too much stiffness in working the engine?
A. Yes; it caused too much work on the engines with the blast we got.
Q. Were the leather valves in the engine at the same time the brass ones were there?
A. Yes, sir; there are brass valves in one engine and brass in another.
Q. Did these parts occasion thumping?
A. No, sir.
Q. How many of these were in the engine?
A. 80.

Q. Then the leather valves were substituted you do not know whether at Mr. Gordon's direction or not?

A. No, sir.

Q. Then, when the leather valve was substituted, what defect came from it?

A. I found that the valve seat was not large enough to allow for shrinkage of the leather and the air worked back into the engine.

367 Q. Then you undertook other remedies?

A. Yes, sir.

Q. Will not these shrink also?

A. Yes; they will shrink in the same proportion, but the valve's seat being larger, it will take longer time.

Q. What is that (indicating)?

A. That is a pin.

Q. What kind of a pin?

A. Out of the rock shaft.

Q. What defect, if any, does it show?

A. That it has been worn for want of oil; it apparently left the shop too loose, and has been center-punched to make it larger.

Q. You say that wearing of that pin was occasioned for lack of oil?

A. Yes, sir.

Q. Was any way made to oil it?

A. No; not while it is running.

Q. How does it have to be oiled?

A. By unhooking and stopping the engine.

Q. Can these engines be started, when stopped on the even stroke, by the use of a lever on the foundation?

A. No, sir; there are holes bored in the fly-wheel for that purpose. It has no business within four or five feet of the foundations.

Q. Does this rubber valve that you substitute wear better than the others?

A. No; not any better, but I thought would be cheaper in the end—last longer.

By Mr. GUNTER:

Q. How long have you been about blast furnaces?

A. About four months.

Q. Never before that?

A. No, sir.

Q. Never saw this kind of valve before?

A. No, sir.

Q. You don't know how they were fixed in other furnaces?

A. No, sir.

Q. You say the objection to these valves was the power of

368 blast it took to lift them up?

A. Yes, sir.

Q. These are good valves with that exception?

A. Yes.

Q. Do you know what the area or weight of these valves is?

A. No, sir.

Q. Could you calculate the pressure that it would take to lift these valves?

A. Yes, sir.

Q. There are forty in operation at once?

A. Yes, sir.

Q. You say you can get four or five revolutions more with the leather valves than with the brass ones?

A. Yes, sir; on account of the greater lift on the other valve and on account of its being lighter.

Q. The area of the valve is 13⅓ sq. in. What is the weight?

A. I do not know.

Q. Putting the weight at ¾ of a pound, what pressure would it take to lift it up?

A. That depends upon what resistance it has of blast pressure.

Q. Without any pressure at the back?

A. It would just take 12 ounces, without any pressure, to raise it.

Q. What would be the pressure per square inch upon the cylinder?

A. I don't know.

Q. You cut the seat of the old valve a little so as to enlarge it for the leather valve which you introduced?

A. Yes, sir.

369 *Rebuttal Testimony of J. H. Murphy. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

370 JAS. H. MURPHY recalled for respondents.

Direct examination by Mr. WHITE:

Q. How long have you been engaged at the Cole furnaces?

A. Twelve months; since last September.

Q. How long have you been engaged as an engineer?

A. Since November.

Q. In what manner did you start those engines off?

A. I always shut the steam off and started with the throttle valve.

Q. Did you ever start or stop them by uncoupling?

A. No, sir.

Q. Have you ever seen it done?

A. No, sir; not on my shift.

Q. That means you are on at night one week and during the day the next?

A. Yes, sir.

Q. When these engines are started off on an even stroke and it is necessary to use a crowbar upon what do you rest the bar?

A. There are holes along the back of the wall for that purpose.

Q. Can you get a lever on these foundations?

A. No, sir; you cannot get to the foundations.

371 *Testimony of R. H. Hammond. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

372 R. H. HAMMOND sworn for complainants.

Direct examination by Mr. GUNTER:

Q. Where do you live?
A. In Lebanon, Pa.
Q. What is your business?
A. I am in the boiler business—boiler and plate-iron work.
Q. What is your profession?
A. I am a machinist by trade.
Q. Does that involve mechanical engineering?
A. Yes, sir.
Q. Do you know anything about blast furnaces?
A. Yes, sir; I have been around blast furnaces all my life.
Q. Did you have anything to do with the construction of those furnaces at Sheffield?
A. Yes, sir.
Q. In what capacity?
A. I was superintendent of construction for Gordon, Strobel & Laureau.
Q. Did you ever have anything to do with the construction of furnaces before that?
A. Yes, sir.
Q. How many?
A. Five.
Q. Are you connected with Gordon, Strobel & Laureau now?
A. No, sir; I am carrying on business on my own account at Lebanon, Pa.
Q. Who superintended, if anybody, the construction and erection of these furnaces on the part of the defendant-?
A. Maj. Edward Dowd.
Q. Did he overlook your work?
A. Yes, sir.
Q. Did he do so carefully or otherwise?
A. Carefully.
Q. Did he require any changes?
A. Yes, sir.
Q. Did you make all the changes that he required or desired?
A. Yes, sir; everything.

(It is admitted that Mr. Dowd passed upon and inspected the work every two weeks and made and demanded such changes as he thought proper, and that he represented defendant- under that contract by authority in the contract.)

Q. State what was the character of the foundations for the
373 engines and boilers?
A. The foundations were put in of brick and cement.
Q. Have the boilers any foundations?

A. Yes, sir.

Q. Were they strung at each end on eye beams and supported by iron posts?

A. Yes, sir; these posts rested on a cast-iron block, resting on the foundations.

Q. These boilers are independent of the brick-work?

A. Yes, sir.

Q. It would make no difference if any of the brick-work were taken away?

A. No, sir.

Q. There is no such thing as the foundation sinking in the center?

A. No, sir; it would not effect the boilers at all.

Q. Did you ever see this kind of boilers elsewhere?

A. Yes, sir.

Q. State whether or not this eye beam was a sufficient support for these boilers.

A. Yes; I never saw any stronger.

Q. This was the usual size?

A. Yes, sir.

Q. Do you know anything about this class of boilers? How do they compare with other boilers? You are a maker of boilers yourself?

A. Yes, but I do not make that kind of boilers.

Q. They are a good boiler?

A. Yes; I guess they are better that any other boiler; they are erecting them almost all over the country.

Q. How was this foundation made?

A. Excavation was made down to hard gravel.

Q. Is not hard sand the best foundation in the world, except solid rock?

A. Yes; it is almost a solid mass; you can hardly sink a pick into it.

Q. You consider that foundation such as ought to be attained?

A. Yes, sir.

—. ——.

Q. Yes, sir; we picked out all the best brick we could find for the foundations, and all the hard brick were thrown aside for that purpose and we laid them with good cement; they were laid very carefully.

Q. What sort of cement?

A. I think it was Portland. The brick were carefully laid
374 and very particular pains were taken to see that everything was filled with cement. After that was done the foundations stood several weeks before we commenced to set up the engines. That was done to let the foundations dry.

Q. Did you ever see, in the course of your experience, foundations that were better than these?

A. No, sir.

Q. Did you ever see them made of better material?

A. No, sir.

Q. Did you ever see any better workmanship?

A. No, sir.

Q. Do you think it possible for these foundations to have settled at all?

A. No, sir.

Q. How high were these foundations?

A. About twelve feet.

Q. How deep did you sink the foundations in the ground?

A. They are in the ground about ten feet.

Q. Do they come up with the general level of the ground?

A. Yes, sir.

Q. What are the dimensions of the foundations for the engines?

A. I don't remember exactly. I should say 8 feet wide and 12 to 14 feet long at the bottom.

Q. Would not the cement in there sustain anything without the brick almost?

A. Yes; if you could get cement in there without the brick it would no doubt sustain the engines.

Q. Did you superintend all this yourself all the time?

A. Yes, sir. I came there after the foundation of the furnace was started. I was not there when it was laid off. The foundation of "A" furnace was in when I got there, but not of the engines. I put all seven of them in.

Q. And you say you never saw a better job?

A. No, sir.

Q. Did you put the engines on?

A. Yes, sir.

Q. How were they put on—in what sort of way, proper or otherwise?

A. Yes; I think they were put up properly.

Q. Was the top leveled off?

375 A. Yes, sir; the bed plates were placed on the foundations and packed under the cast-iron boarding. It was packed with a kind of paste that becomes solid.

Q. Do you know the weight of these engines?

A. Yes, sir.

Q. If these engines were run properly, would there be any strain upon that bed plate to pull it up or down?

A. No, sir.

Q. The strain in an engine that is run properly is what is called self-contained, is it not?

A. Yes, sir.

Q. State whether or not, in your opinion as a mechanical engineer, these bed plates were of sufficient strength for the purposes for which they were intended.

A. Yes, sir.

Q. Have you seen heavier engines than these of the same cylinder bore anywhere?

A. No, sir.

Q. Is it at all necessary to have more fastenings than the four bolts that were put in these bed plates?

A. No, sir; I have never seen more than four bolts in that size engines. That is entirely sufficient if properly run.

Q. Have you seen blowing engines run in the shops where they are made?

A. Yes, sir; a good many of them. I have helped to erect them.

Q. Did you ever serve an apprenticeship?

A. Yes, sir.

Q. What was the business of that shop?

A. Making blowing engines.

Q. How long?

A. Four years.

Q. What is your age?

A. 27.

Q. Would there he any strain upon the bolts holding down the caps upon the shaft if the engine was properly adjusted and attended to?

A. None at all; you could take the caps off, under ordinary working of the engine, and the shaft would not rise.

Q. To require any necessity for these caps there would have to be some extraordinary force that would raise the whole load of the moving parts of the engines?

A. Yes, sir.

Q. And when the engine is properly run there is nothing
376 to raise the moving parts of the engine at all?

A. No, sir.

Q. What is the weight of the moving parts of these engines, including the cross-head of the piston, the piston rods, fly-wheel, and shaft?

A. I should judge about thirty tons.

Q. If in running these engines water should be allowed to come over from the boiler and get into the cylinder and should remain in the cylinder until the return stroke of the piston down upon it what would be the effect?

A. It might blow out the cylinder head.

Q. Suppose the cylinder head was too strong to blow out?

A. It would raise the shaft.

Q. Would not that break the bolts?

A. Yes, sir.

Q. And when the shaft was released from this lifting force by the piston starting on its return stroke, what was the result?

A. The whole load would come down on the top of the bed plate—about thirty tons.

Q. If the water kept on coming over or if there was any improper lead of steam put in the cylinder, state whether or not that stroke would be repeated at every stroke of the engine.

A. It would be.

Q. Tell me what kind of machinery would be able to stand such pounding as that would create.

A. I don't think any machinery made.

Q. State whether or not such action as that would break any bed plate.

A. It would.

Q. State whether or not, in your opinion as a mechanical engineer, these bed plates could have broken in any other way than that.

A. No, sir.

Q. Suppose you start engines of this character off suddenly when there is no blast accumulated in the blast mains, what would be the effect?

A. It would be enough to tear the engines to pieces.

Q. Suppose that in addition to that they had been stopped some time and there was water in the bottom of the cylinder, would that make the matter better or worse?

A. It would make it worse.

377 Q. Suppose it is desired to stop these engines when running at full speed and under heavy pull, state how it should be done.

A. With the throttle valve and not by uncoupling. It is necessary to stop upon the whole momentum of the engine.

Q. State whether or not in the construction of that throttle valve it is so that the steam is gradually cut off; can it be cut off suddenly?

A. No; it must be cut off slowly.

Q. Did you ever in your experience see engines of this size and character uncoupled while in full motion?

A. No, sir; I never did.

Q. Did you ever see a competent or experienced engineer start an engine of this size and capacity by simply coupling them up?

A. No, sir; a competent and experienced engineer will not start an engine except gradually and slowly.

Q. You know what the lead is to an engine?

A. Yes, sir.

Q. Putting in steam at the reverse end of the cylinder before the full stroke of the piston has been attained, the result is for it to form a cushion in the bottom for it to hit against?

A. Yes, sir.

Q. In blast furnaces where the operation of compressed air above is to resist the pressure of steam as the piston is forced into the steam cylinder below there is a force of air above which is generated and acting as a cushion, is there not?

A. Yes, sir.

Q. In blast furnaces where they are carrying a high pressure is it right that there should be any lead of steam put in?

A. Yes, sir.

Q. To what extent?

A. It varies with the size of the engine; all engines should be cushioned.

Q. Does not the air above cushion it?

A. In that case it does, but very often there would be no air above at the first revolution.

Q. State whether or not in running a blast engine you would

ever have lead enough on which, by all the blast pressure, would have the effect of raising the moving parts of the engine.

A. No, sir; certainly not.

378 Q. That would produce the very faults which you spoke of in reference to the water?

A. Yes, sir.

Q. So, in running a blast furnace the engineer must be careful, must he not, in putting his lead on, what his blast pressure is, so as not to with the two get force enough to raise the moving parts of the engine?

A. Yes, sir.

Q. Did you ever in your experience see steam valves put in steam mains?

A. No, sir; I never have.

Q. State, in reference to the valves which you put in these engines for the delivery of air from the cylinder, what kind they were—I mean the discharge valves.

A. They were leather.

Q. Are you certain?

A. No; I am not certain; I think the discharge- were brass and the inlet leather.

Q. Did you see these engines tested?

A. Yes, sir; I helped test them.

Q. By what means?

A. By an indicator.

Q. State whether or not an indicator is a safe and reliable mode of testing these engines.

A. I think it is the only correct way.

Q. Did not the indicator show you how to adjust the lead?

A. Yes, sir.

Q. The lead in this case—how was it adjusted?

A. By lines in the card.

Q. Did you then try the blowing cylinder with the indicator?

A. Yes, sir.

Q. What was the result?

A. Very favorable.

Q. How did it indicate about the valves?

A. That they were set properly.

Q. State whether or not the indicator card does not mark and show the force and operation throughout the whole stroke. If there was any variation it would be marked on the card?

A. Yes, sir.

Q. Were these, in your opinion, well proportioned?

379 A. Yes; it is the size universally used.

Q. State what test they were put to as to speed, power, etc.

A. When we had the engines erected we fired up one battery of boilers to test the engines, one at a time, and run them empty at sixty revolutions.

Q. How did they operate?

A. Very satisfactorily. We started them gradually, running very slowly so as to work down all the bearings, and then gradually

speeded them up until we had them working sixty revolutions, then we shut down all the air pipes and closed them up so as to blow the pressure and run the pressure up to 8½ lbs., I think, with 40 revolutions. They then operated very satisfactorily. Maj. Dowd was present at this test.

Q. State whether or not, in your opinion, as a mechanical engineer, these engines, properly run as they should be, would run at 40 revolutions with ten pounds pressure.

A. Yes; I think they would.

Q. Have you seen these engines of this pattern used elsewhere?

A. Yes; I have seen one.

Q. Where?

A. At Centralia, Illinois.

Q. By pattern it is obliged to be identically the same engine?

A. Not the same weight, but style. I never saw identically the same engine.

Q. In your observation of engines did you see any faulty part in the construction of these engines there as to strength or quality of material or workmanship?

A. No, sir.

Q. Did you ever see steam valves in steam mains?

A. No, sir; I never have.

Q. As a mechanical engineer would you think they were necessary or useful?

A. No, sir; they are not necessary or useful; it would be a mistake in having them there.

Q. If these flange joints on steam mains are properly made in the first place and the mains covered up would they be likely to get out of order?

A. Not likely. *A.* The joints would occasionally spread out.

380 Q. What is the trouble of repairing them?

A. No serious trouble—a matter of a few minutes' work.

Q. Did you put these joints up?

A. Yes, sir; they were put up under my direction.

Q. Were they covered when first put up?

A. No, sir; they were left exposed to the weather.

Q. What would be the effect of water upon these joints when they were being used with steam?

A. It would create leaks that would not occur if they were covered up.

Q. Should not all steam mains of this character be covered?

A. Yes, sir.

Q. What kind of packing did you use?

A. The very best—the Usudurian. It is supposed to be the best packing on the market.

Q. Were you there when furnace "A" was started?

A. Yes, sir.

Q. Were these pipes then tight?

A. Yes; perfectly.

Q. State whether or not a few days after that any storms or rains occurred.

A. Yes, sir; three days after that we had a terrific storm, and the boilers were uncovered and exposed to the rains.

Q. State whether or not any leaks appeared in the pipes then.

A. Yes; some few after that storm.

Q. Do you think the storm had anything to do with the leaks?

A. Yes, sir; had all to do with it.

Q. In reference to the steam to the pumps, state whether or not it was necessary to have a steam main for the pumps separate from the steam main for the balance of the plant.

A. No, sir; it is not necessary.

Q. Is not a proper mechanical construction to connect the pumps by a line directly on the steam main?

A. Yes; that's the usual practice and was done in this case.

Q. State if this plant was so constructed that you could take out any one or both of the pumps at the river and run the plant with the pumps at the pump-house.

381 A. Yes; you could take out both of the pumps or take out either of them.

Q. You could run with one of the pumps at the river and the pumps at the pump-house?

A. Yes, sir.

Q. If the pumps got out of order at the pump-house, state whether or not you could make a connection with the river pipes so as to make them do the duty.

A. Yes; there were valves for that purpose.

Q. Did you ever see anything more complete than that?

A. No, sir; I never have.

Q. These furnaces each had one hoist?

A. Yes.

Q. State if it is usual or necessary or economical to have a bridge connecting these three hoists for the purpose of taking the fuel and charge from one hoist over to another furnace.

A. It is a very usual thing and not at all necessary; there is no economy in it.

Q. How would such a bridge be supported?

A. It would be hard to support a bridge at that distance; you would have to truss it.

Q. Did you ever hear of such a thing?

A. Yes; I have seen a bridge from furnace to furnace, but the furnaces were not more than 80 ft. apart.

Q. Did you ever hear of one this distance apart?

A. No.

Q. How many furnaces have you ever seen?

A. I suppose 250.

Q. Then this is a new idea, this bridging?

A. No; I should say it is an old idea carried out of use.

Q. If all these three furnaces were in operation and one hoist gave way, could the hoist of another furnace do the duty for two furnaces?

A. No; it is not supposed to.

Q. Did you ever see two hoists for one furnace?

A. No.

Q. The hoist of one furnace is just as liable to give out as the single hoist for three furnaces?

A. Yes, sir.

Q. And repairs are just as easily made on the hoists of the three furnaces as on the single hoist?

382 A. Yes, and you would have to neglect both furnaces.

Q. Suppose the hot-blast mains were connected by a continuous pipe, what would be the effect of the expansion of the connections of the hot-blast mains with the furnaces?

A. It would pull the connections off the stoves; the expansion is too much.

Q. What would you think of the mechanical idea of connecting the hot-blast mains throughout by pipes about 300 feet long?

A. I think it would be an absurd idea.

Q. Did you ever see such a thing done?

A. No, I never have with three furnaces and a pipe so long. I have seen them on two close together.

Q. In how many cases?

A. Only one.

Q. Looking at this plant as a whole, state whether or not it was incomplete in any respect so far as you were able to discover.

A. I should say that it was one of the most complete plants that I have ever seen in every detail.

Q. In reference to the masonry and character of materials put in the furnace, what was their character?

A. The best material was used in the furnaces, and the workmanship was the best.

Q. Were any holes or spaces left where bricks should be?

A. No, sir.

Q. How was the iron taken out of the cast-house?

A. By an overhead railway suspended from the roof, and carried out of the doors on to the cars.

Q. Was it intended that it should be thrown out of the side openings?

A. No, sir.

Q. By the construction of this plant would the foundation walls in the openings in the cast-house be *be* exposed to any use whatever?

A. No, sir; except a man standing on them occasionally.

Q. In the ordinary construction of cast-houses are not these side openings intended to take the iron out of?

383 A. Not in all cases, but sometimes they do; in this case it was intended to carry the iron out by an overhead railway on to the cars.

Q. State whether or not there would be any more uniformity in the flow of gases and supply of steam if all the furnaces were operating rather than one.

A. Yes, sir; you would have more gas by running three furnaces. You would not lose so much by the radiation of steam pipes. The pumps run at the river for one furnace, and the pumps at the res-

ervoir would answer for the running of three furnaces. They would have the same radiation for one as they would for all three.

Q. Would not there be this further difference: If you run one furnace would not there be the expense of casting iron? Does the gas flow then?

A. No, sir.

Q. You might have a constant flow of gases by running all three furnaces?

A. Yes, sir.

Q. Was there anything in the construction of these furnaces to make the flow of gases less than it would be in other furnaces?

A. No, sir; it depends upon the fuel and the way it is applied entirely.

Q. Under ordinary and usual conditions state whether or not this boiler is a good producer of steam, as compared with others.

A. Yes, sir; better and quicker.

Q. And the square feet of heating surface in these boilers is just as effective for producing steam as in any other boiler?

A. Yes, sir.

Q. You were there when furnace "A" was blown in?

A. Yes, sir.

Q. What about the character of the labor and help?

A. They were the worst kind we could get hold of. They were men who had never worked around a blast furnace and didn't know what a furnace was, and you could not get them to do anything; you would have to do it yourself. In regard to working the furnace they would not take hold of the work as they should. They were perfectly green. In reference to filling the furnace most of the men at night would be sleep-. I have seen men running over the scales with stock with only one wheel on the scales and the other on the floor, and never weighed the stock.

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Q. Did not a storm come up just as you started out?

A. Yes, sir; we had a very severe storm. It rained for about four days. The furnace started up nicely and worked well until we had this heavy storm. It commenced raining on Sunday after the furnace started and Saturday and rained on Monday, Tuesday, and Wednesday and up to Thursday. The water was running into the furnace at the top.

Q. What effect did that have?

A. A very bad effect upon the working of the furnace. Everything was green and damp and new, and all this heavy rain running into the furnace put out the fires. The air that was going into the furnace was full of moisture. A storm of that kind is very hard on a furnace in operation and is much harder on one just starting.

Q. How did that rain-storm compare with ordinary hard rains? Was there anything unusual about it?

A. Yes; very unusual for the amount of water that fell, and the storm lasted about three days.

Q. State what difficulty was encountered in reference to the sand in the cast-house of furnace "B."

A. It was very poor. In making casts we had boil after boil. The iron, instead of running into pigs, all ran into a mass and buried itself down in the sand three or four feet. There were two or three tons in each mass. We had to stop to clean out the cast-house, so as to make room for another cast.

Q. While Mr. Gordon was in charge was there any change in the sand?

A. No, sir; not to my knowledge.

Q. You say you have to stop. How long did you have to stop?

A. Anywhere from four to twenty-four hours.

Q. What's the effect of that?

A. Very bad upon a new furnace. A new furnace should not be put through all the time without making any stops at all.

Q. If it stops that way for any length of time where does the heat go that is in the furnace?

385 A. A greater portion of it—there is no blast in it and the fire dies out.

Q. Is such a thing as that liable to cause scaffolding?

A. It is at times. If the furnace is working very hard it is very likely to scaffold. If it is stopped, the materials are likely to build up and make a scaffold and make the furnace work irregularly. You might work the scaffold out and you might have it in there the engine blast.

Q. What became of this iron that runs into these big lumps?

A. It was thrown out and not thrown back into the furnace.

Q. Was it weighed up as pig-iron?

A. No, sir.

Q. The furnace did not get credit for that iron?

A. No.

Q. It was just as good iron as the other?

A. Yes, sir; but it was not in proper shape.

Q. How long did the furnace have to stop on this account?

A. For a week we stopped at almost every cast.

Q. How was the help and hands about the furnace?

A. As poor as we had at the first.

Q. State whether or not the efficiency depends, in a large degree, upon the labor around about the furnace.

A. Very much so. It takes longer to do the work, and the men do not seem to take the interest in the work as they should.

Q. What is the weight of the moving parts of these engines—that is, the fly-wheel, shaft, cross-head, piston, and connecting rods?

A. I should say thirty to thirty-two tons.

Q. If the engine was running properly, would there be any tendency for these moving parts to rise and lift out of their seats unless there was a lifting force exceeding the weight of the moving parts of the engine?

A. No, sir.

Q. In such cases, then, could the caps be removed from the top of the main shaft without danger?

A. Yes, sir.

Q. Suppose the blast cylinder is 84 in. in diameter or
386 5,541 sq. in. in area, what would be the pressure on the blast piston to overcome and counteract the weight of the moving parts of the engine and lift, to any extent, the main shaft of the engine out of its bearing?

A. I cannot tell.

Q. Would there be any more danger in running the engine fast than slow, within any reasonable limit of speed, except as to the danger of the fly-wheel breaking or the steam being unable to escape?

A. No, sir; there would not.

Q. What speed did you see these engines run at?

A. At first they were run at sixty revolutions, empty and with no resistance.

Q. If a load was put upon the engine and that load did not equal the weight of the moving parts of the engine, would there be any difference between running the engine loaded or unloaded, so far as its safety is concerned?

A. No, sir.

Q. Where are the strains and stresses upon an engine running fast rather than slow, leaving out the danger to the fly-wheel—on what parts of the engine?

A. They are all on the bearings and *risk*-pin; they are made in proportion for a high-speed engine; the wear is not any more on a high than on a low speed engine.

Q. How do the bearings and *risk*-pins compare with those on other engines?

A. In every respect with other engines that are supposed to be good furnace engines; the *risk*-pins are as large.

Q. You think they are large enough for a speed of from 40 to 60 revolutions per minute?

A. I should think so.

Q. How are the piston rods and cross-heads?

A. They are amply heavy enough and well proportioned.

Q. In running fast does not that increase the strain upon the bed plates and fixed parts of the engine?

A. No, sir; I should not say it would.

Q. At what part of these bed plates is it strongest?

A. In the center, right under the shaft.

387 Q. How is that made stronger?

A. The bearings are 24 in. wide.

Q. State whether or not in blast engines there is required a constant renewal of air-blast valves.

A. Yes; there is.

Q. State what were the arrangements made in this plant for the rapid renewal and removal of the seats and valves to these engines.

A. I have never seen valves that you could remove and renew quicker than the valves in these engines.

Q. How long do the valves in any blast engine last ordinarily?

A. They might last six months, and some last over a year, but there are always a few that have to be renewed.

Q. Have you seen many furnaces?

A. Quite a number.

Q. Assisted in erecting them?

A. Yes, sir.

Q. State what was the character of the banding of these furnaces in comparison with others.

A. I never saw furnaces banded better than those at Sheffield.

Q. In blowing in these furnaces "A" and "B" you were there?

A. Yes, sir.

Q. All the time?

A. Yes, sir.

Q. State whether or not Mr. Gordon had control and management of these operations or merely gave directions through Mr. Doud.

A. He didn't control the charge or any of the men; he merely gave directions through Mr. Doud.

Q. Who employed the men?

A. Mr. Doud, I suppose. Mr. Gordon had nothing to do with the employment or selection of the men.

Q. Did he have anything to do with the supply of sand, coal, coke, or ore?

A. No, sir.

Q. Were they supplied while he was there or during his absence?

A. They were supplied during his absence and they received some supplies while he was there.

Q. Mr. Gordon is a competent man, you think, to operate furnaces?

A. Yes, sir.

388 Q. You have been present and seen him operate furnaces successfully?

A. I have; on several occasions.

Q. What attention did he give to the operation of these two furnaces?

A. He was at the furnaces the entire time and has been there thirty-six hours at one time; he gave them all of his attention that he possibly could and did everything in his power to make a success of it.

(Defendants do not dispute Mr. Gordon's ability and competence and that he did the best he could at these furnaces. Defendants admit that the guarantee clause of the contract of the additional $20,000 was never accepted.)

Cross-examination by Mr. WHITE:

Q. What did you say you are?

A. A machinist by trade.

Q. Your knowledge of mechanical engineering extends only to that which you have learned from your trade?

A. Yes, sir.

Q. Did you ever have charge of a furnace?

A. Not full and direct charge.

Q. What is the greatest extent of authority that you have ever had at a blast furnace?

A. I was an assistant manager.

Q. How long and when was that?

A. For two years about three years ago—a little more.

Q. What was embraced in the duties of assastant manager?

A. I had charge of the men and looked after the stock going into the furnace, but as to burdening the furnace I got my orders from the manager.

Q. How many furnaces are there in the United States?

A. That is a question I cannot answer at once.

Q. You have an idea, haven't you?

A. I should judge close onto one thousand.

Q. Is there more than five hundred?

A. I should say so.

Q. Are there more than 350 blast furnaces in the United States in blast?

A. I should say so.

Q. You think it nearer a thousand than that number?

389 A. I do.

Q. You have seen 250 or 300 furnaces?

A. About that many.

Q. Do you mean that you actually saw them or have been to and examined them?

A. I have examined some of them and have been to all of them; never made a close examination of them, however.

Q. Your visits to them, I suppose, were merely casual?

A. On business, but not for the purpose of examining them.

Q. The examination that you did make—that was suggested by mere curiosity, I suppose?

A. Yes; on my part.

Q. You say that the brick under the boilers has no duties to perform as a foundation for the boilers?

A. No, sir.

Q. Then the brick are not there with reference to affording a support to the boilers at all?

A. No, sir; the foundations may possibly be levelled up with a few courses of brick.

Q. You say these boilers are suspended to an eye beam?

A. Yes, sir.

Q. The ends of the eye beams rest on iron columns that go down and rest on the stone foundation?

A. Yes, sir.

Q. There are two boilers under each eye beam?

A. Yes.

Q. Is there a centre iron column supported by stone, on which that centre eye beam rests?

A. No, sir.

Q. Then is the brick wall worked up to the eye beam between the two boilers?

A. No, sir.

Q. What does the center eye beam rest on?

A. On nothing; there is no center support to the eye beam.

Q. How is it possible for the eye beam to shrink in the middle?

A. It is not possible.

Q. It is not possible for it to get out of line?

A. Yes; it is possible.

Q. Then it is a mistake when it is asserted that one of the eye beams has sunk two or three inches in the center?

A. I have not seen the boilers, but I should say it is a mis-
390 take. The center walls does not touch the eye beams—not within 18 inches.

Q. Is not there a center wall coming up towards the eye beams?

A. It runs up between the boilers about 18 inches of the eye beams.

Q. Is not there a support to the eye beams from that centre wall?

A. No, sir.

Q. You say you think these are the best boilers made?

A. I think so.

Q. Did you say yesterday that they might be better or that they were better than any other boilers? Are they the best boilers or are there others as good?

A. They are equally as good as any other, and are being put all over the country.

Q. You say you superintended the laying of these foundations and were there all the time?

A. Yes, sir; every day.

Q. Were you there at that work all day and did you inspect the laying of the brick and how often?

A. I suppose eight or ten times a day.

Q. Could not there have been poor materials put in those foundations between the time of these inspections that would have escaped your notice?

A. No, sir.

Q. You say you superintended the constructions of the furnace after the foundations were laid?

A. Yes, sir.

Q. It was under your supervision?

A. Yes, sir.

Q. You were back and forth frequently?

A. Yes, sir.

Q. Could not the work on that furnace during the time you were not present have been put in a slipshod manner and you not notice it?

A. No, sir.

Q. Then there was no defect in a brick-work that the man could run his arm through?

A. No, sir.

Q. Then if this — asserted to be a fact it is a mistake?

A. I would say so.

391 Q. Did you see the mixing of the sand with the cement that this work was put up with?

A. Most of it.

Q. Could not the mixture of these materials have changed in your absence to such an extent that it would have effected the cement and you not have known it?

A. I don't think so from the number of empty barrels on the ground.

Q. And the value of the cement simply depends upon the quantity of sand and cement?

A. Yes, sir.

Q. Too much sand in cement mortar will make it of little more value, if any, than lime mortar?

A. Yes, sir.

Q. Cement mortar, if after becoming dry you can crumble in your hands, is not good mortar, is it?

A. No; it is not good cement.

Q. Where did you board while superintending this work?

A. At the Parshall house, Tuscumbia, part of the time.

Q. What time did you go to work in the morning?

A. From seven to 7.30.

Q. What time did the workmen get there?

A. Seven o'clock.

Q. Where did you take your dinner?

A. Tuscumbia.

Q. What time did you go to dinner?

A. About 12 or 12.30.

Q. What time did the workmen get to work after dinner?

A. One o'clock.

Q. What time did you get back from dinner?

A. One or 1.30.

Q. Then there was some time in the morning and afternoon that you were not there?

A. Yes, sir.

Q. Did they ever work at night any?

A. Not of any account; not any matter of construction.

Q. After these furnaces were built up to a certain height do the men work from the inside or outside?

A. Inside.

Q. Then an inspection of the work from that time required that a man go inside?

A. Yes, sir.

392 Q. How often did you do that?

A. Three or four times a day.

Q. You say you built these foundations up and leveled them off?

A. Yes, they were made perfectly level.

Q. Is the bottom of a bed plate to an engine perfectly level?

A. Yes, sir.

Q. Is it smooth?

A. Yes, sir; I think they were machined off.

Q. They are made hollow onside?
A. They have a flange on the bottom.
Q. But it don't reach clear across?
A. No, sir.
Q. How did you get the iron filling in?
A. We had a piece of flat iron and hammered it in.
Q. Then you put the bed plate down on the foundation and hammered the filling in after?
A. Yes, sir.
Q. Those iron filling- were for the purpose of leveling up the bed plates?
A. Yes; for the purpose of giving it a solid bearing all around. It must be placed either on the iron plate or on sulphur.
Q. Is it possible for these iron fillings to work out or get loose?
A. No, sir.
Q. Do you think it possible for the brick in these foundations to become so disintegrated that the mere rubbing of the hand would shatter them?
A. No; it is not possible.
Q. Then, if this is stated as a fact, it is a mistake, is it not?
A. Yes, sir.
Q. You say the strain in an engine is self-contained?
A. Yes, sir.
Q. That is, the main parts are so adjusted that they are equalized and keep the strain within the parts of the machinery?
A. Yes, sir.
Q. Why do you bolt an engine down?
A. In case of blowing them at a very high pressure it is necessary to bolt them.
Q. Then an engine is bolted down only with a view to running it up beyond its capacity?
A. To keep it in its place. The vibration will partly
393 move it.
Q. Then it is a mistake to suppose that the engines could set up on the foundations and not work off?
A. That depends altogether on the weight of the engine and the speed of running.
Q. Take the weight of these engines blown at the speed they are?
A. Should say they would work off the foundations.
Q. What is the weight of these engines?
A. Seventy tons. They are as heavy as any engine of that size.
Q. What do you mean by that size?
A. The size of the steam cylinder and blowing cylinder.
Q. On ordinary engines is the proportion, then, the size of the steam cylinder and the blowing cylinder?
A. Yes, sir.
Q. And 140,000 pounds is the usual weight of an engine of that size?
A. Yes, sir.
Q. Do you know the weight of the Weimer engine?
A. Yes; it is 140,000 pounds.

Q. Is it not 190,000?
A. No, sir; 140,000.
Q. Do you know the McIntosh & Hemphill engine?
A. No, sir; I do not know their weight.
Q. Were you ever at the Edward Thompson furnaces?
A. Yes, sir.
Q. What engines do they use?
A. I do not know.
Q. Have you been around any furnaces in Pittsburgh?
A. Yes, sir.
Q. Do you know the weight of the engines there?
A. No, sir; I do not know the kind and weight of any engines around Pittsburgh.
Q. You stated that if water should come over from the boilers and get into the cylinder and remain until the return stroke of the piston the result would be that it would blow out the cylinder head or break some other part of the engine?
A. Yes, sir.
Q. The first force would be visited upon the cylinder head?
A. Most likely.
394 Q. Then where next?
A. From the piston to the cross-head and down to the shaft.
Q. If it did not break anything at all, but got to the shaft, the result would have been that it would have broken the caps of the shafting or the main shaft?
A. If the caps were down perfectly tight it is hard to say what part of the engine it would break.
Q. Then if it did not break that part what would be the result?
A. The engine would stop there and rock.
Q. Then the machinery is made in point of strength to successfully resist all obstructions that are not greater than the weight of the moving parts of the engine?
A. No, sir.
Q. If you put too much blast pressure the result will be the same as if there is too much water in the piston; suppose there is so much pressure that the engine could not run?
A. You could not start the engine.
Q. Suppose there is too much water in the cylinder and on the return stroke of the piston it would form a cushion, what would be the result?
A. It would break some part of the engine.
Q. Through which parts is the concussion of the force transmitted to the bed plates?
A. Through the connecting rod.
Q. That concussion is got to be transmitted through this part?
A. Yes, sir.
Q. In any irregularity in the operation of an engine that would result in the breaking of a bed plate from concussion would it not be of sufficient notability to attract the attention of any man that was standing around the engine?

A. There depends altogether upon the amount of the concussion and where the man was standing. He might be standing at the other end of the house.

Q. A small amount of concussion might break it, then?

A. No, sir.

Q. The proposition was that the bed plate was broken by
395 concussion; if a man was standing there would not the breaking and concussion be of sufficient notability that he would notice it?

A. It depends altogether on the man. If he is a competent engineer he would notice it.

Q. Do not all concussions make more or less noise?

A. Yes, sir.

Q. Are not all thumpings noticeable to a man?

A. Not all of them.

Q. Then there are thumpings that are not noticeable?

A. They might be in one part of the engine, and you would look for it and find it elsewhere.

Q. Then as big a thing as a blast engine could be so out of order that it could break the bed plate and the man in charge would not know anything had happened?

A. A competent engineer would know it.

Q. Although he had not heard the thumping?

A. A competent engineer would hear it. You might run a man in there that would not know an engine from the side of a house.

Q. The- that man would not, of course, know anything about it?

A. No, sir.

Q. Suppose the man there is a competent engineer, then he will know, will he?

A. Yes, sir.

Q. Then your negative answer was based upon the supposition that the man there did not know an engine from the side of a house?

A. It was based upon the idea that it was a man and not a competent engineer, but if he was competent he would know these things.

Q. Then you say that the bed plate could have been broken in no way except by concussion that resulted from too much water being in the cylinder?

A. No, sir; constant thumping or lifting of the shaft.

Q. You say that starting the engine off suddenly is sufficient to tear them all to pieces?

A. Yes, sir.

Q. Is that a possible result or probable?

A. Probable.

Q. That means, then, that it is very likely to tear them all to pieces?

396 A. Yes, sir.

Q. Does it ever become necessary in the operation of a furnace to stop the engine suddenly?

A. No, sir.

Q. Suppose you have in your engine what is called a sand-boil, is it not desirable to get the blast off the engine as quick as possible?

A. Yes; but it is not necessary to stop the engine suddenly; it will not benefit your boil.

Q. But it shuts off the blast from the furnace?

A. Yes.

Q. Will it run at the same speed?

A. No, sir; not as fast.

Q. Then it is desirable in case of a boil to get off the blast as quickly as you can safely?

A. That depends altogether upon the boil; if you have a very bad boil at the beginning of your cast, you would not have any pig-iron at all, and it is desirable to stop your engine; but if you are casting and have several *bets* of pig-iron, in that case you can slow down your engine.

Q. Does the iron ever break out of the furnace?

A. Yes, sir.

Q. It is necessary, then, to shut off the blast?

A. No; not suddenly.

Q. There is no emergency that calls for uncoupling the engine, then?

A. No, sir.

Q. You say the lead of these engines was adjusted by an indicator card?

A. Yes, sir.

Q. That's the proper adjustment?

A. Yes, sir; I believe so.

Q. Did you make that indicator card?

A. No, sir; I was there at the time.

Q. That's a registering of the engine, is it not?

A. Yes, sir; it gives an idea of the opening and closing of the valves.

Q. You identify that as the card?

A. Yes; I was there when it was made.

Q. You say you have never seen this kind of an engine of
397 the same size and pattern at any other place?

A. Yes; two at the West Nashville furnaces.

Q. Were not these boilers covered with brick and cement?

A. Yes, sir.

Q. Were not the pipes all covered within six weeks after the furnace started?

A. I do not know. I was not there. Not within six weeks after furnace "A" started.

Q. You say the idea of connecting the hot-blast stoves is absurd?

A. Yes; I should think so.

Q. Did you ever see two furnaces together where they were not connected?

A. Yes, sir.

Q. You have seen them where they were connected?

A. Yes.

Q. Then it is not absurd to connect two furnaces?
A. In this particular case it would be absurd.
Q. You have an exalted idea of your opinion?
A. No, sir.
Q. When you have such idea of the opinion of other people, haven't you got a good deal of what is called cheek?
A. You might put it that way. I think I have had as much experience.
Q. Why is the idea absurd?
A. For the simp-e reason that in this plant the furnaces are so far apart you would have trouble in the hot-blast main.
Q. If there were only two furnaces, would it not be practicable?
A. No, sir.
Q. Why, because of the length of the pipe?
A. No; because they have three stoves.
Q. Then the idea may not have been absurd. The fact that you do not need a thing a man suggests does not make it absurd.
A. No; but in this case I should say it was absurd.
Q. The reason you gave was on account of the expansion. Now, for what other reason?
A. Because each furnace has three stoves, and two stoves
398 are sufficient to run one furnace.
Q. You say it is impracticable to connect the hot-blast main between two furnaces for what reason?
A. For the reason that two stoves are sufficient to run one furnace.
Q. And for what other reason?
A. If you connected the hot-blast mains, the expansion would tear the connections out of the stoves.
Q. How far apart were the two that you saw connections in?
A. I don't remember.
Q. The expansion is the extra lengthening of the pipe from the hot air passing through it?
A. Yes.
Q. Cannot that be counteracted by joints?
A. Yes, sir.
Q. Could not you overcome all expansion that would be created in this instance?
A. It is not desirable.
Q. Couldn't you do it?
A. Not successfully.
Q. These mains expand already, don't they?
A. Yes, sir.
Q. How much?
A. Four inches.
Q. Is the distance between these hot-air mains of the different stoves any greater than the hot-air main on each stove?
A. It is not as great.
Q. Then would there be any more expansion in the pipe that would connect the two than there is in the pipe already in use?
A. Yes; it would be double.

Q. Isn't it practicable to overcome eight inches of expansion in a pipe of this length by these joints?

A. It is practicable, but not desirable.

Q. Have you ever seen more than three hot-blast stoves to a furnace?

A. Yes, sir.

Q. How many have you seen?

A. Four.

Q. Was the fourth one an absurd idea?

A. No.

Q. Why?

399 A. The stoves were not as large. You have the extra stove in case any repairs had to be made on any one. They often have a stove standing idle.

Q. Are you speaking of the furnaces at Ensley?

A. No.

Q. They have four stoves?

A. Yes, sir.

Q. Built by your firm?

A. I think the stoves were built by the Tennessee Coal, Iron & R'y Co. They were designed by Mr. Gordon.

Q. Are they the same size as these?

A. I don't know.

Q. If these three stoves here should prove insufficient to run that furnace, then the idea would not be absurd, would it, to have that connection?

A. I don't see how they could be insufficient.

Q. You say that when the hoisting machine of one furnace breaks or gets out of order you have to stop to fix it. There is no arrangement by which you can use the hoist of another furnace?

A. No, sir.

Q. You say it would be of no convenience or practical benefit to have a bridge connecting these hoists of the different furnaces?

A. No, sir.

Q. If the hoist that was running furnace "B" was out of fix and they had a bridge from the hoist of furnace "C," and continued running the furnace until you repaired the hoist?

A. Not successfully; they are intended for only one furnace.

Q. Cannot they be utilized?

A. No; the furnaces are too far apart.

Q. I am supposing that only one furnace is running, and if that hoist was out of fix it would necessitate the stopping of that furnace. Now, if there is a bridge leading from the hoist of furnace "C" to furnace "B," why could you not use that hoist for this furnace?

A. Because it is too far apart; you could not burden the furnace fast enough.

Q. What is capacity of one of these hoists?

A. I do not remember.

Q. Is it not more than sufficient to furnish the burden for one furnace?

A. Yes.

400 Q. Then the hoist would, in the case we have supposed, carry up enough to burden that furnace with, and the only objection is that you would have to carry it too far?

A. Yes.

Q. Your objection is that the distance is too great to be used practicably?

A. Yes, sir.

Q. What is the other objection?

A. That's the objection.

Q. Will not one of these hoists carry up enough stuff to make 200 tons of iron a day?

A. Yes; I should say it would.

Q. There would be no difficulty in the construction of the kind of bridge we are speaking of, would there?

A. Yes; the long spans.

Q. How long would the spans be?

A. 120 feet.

Q. Could not that bridge be built so as to get a bearing on the stoves and the spans would not be over 30 feet?

A. No, sir.

Q. Why?

A. Because the stoves are not in a line with the furnaces.

Q. The bridge would not have to be in a line with the furnaces, would it?

A. Not necessarily.

Q. Then it could be constructed to get its bearing on the stoves?

A. Yes; it could be. You could run a bridge down to the river an- back.

Q. Couldn't you run this supposed bridge exactly in a straight line and get a rest by supporting your bridge on the hot stoves?

A. Yes, sir.

Q. What would be the length of the spans?

A. I do not know.

Q. They would not be fifty feet?

A. No; I should say not.

Q. Then it is practicable to construct that bridge?

A. Yes; it is practicable.

Q. Your objections to it would be based on the economy of it?

A. Yes, sir.

Q. Suppose an engine to a hoist, as connected to a furnace in operation, should break and necessitate a stop of 24 to 36

401 hours to repair it, what damage would probably result to the furnace?

A. It depends largely upon the condition of the furnace. If the furnace was in good condition you could bank it and there would be no damage. If it was in bad condition the chances are you would have some trouble in starting up.

Q. How do you get to the top of the furnace when your engine breaks?

A. By a spiral stairway to the top of the stoves, and then by a ladder to the top of the furnace.

Q. If these bridges were here you could get to the top of the furnace without going up this spiral stairway, couldn't you?

A. Yes, sir.

Q. If I understood you on yesterday you stated that if all three of the furnaces were in operation there would be more uniformity of gases and a more uniform flow of steam than if only one furnace was being operated?

A. Yes, sir.

Q. And that the lost steam by radiation from the steam pipes would not be so great—that is, you lose just as much by operating one as by operating all three?

A. Yes, sir.

Q. You state that as being a scientific fact?

A. From my practical experience and what I know of the effect, I should say that it is the case.

Q. When there is only one furnace in operation, as there is now, and there are valves in the main steam pipe that shut off all of that part of the pipe except that which is necessary to carry the steam from two boilers to the engines, there is no radiation from any of that part of the pipes that are cut off, is there?

A. No; if the valves are perfectly tight.

Q. You stated on yesterday that there would be a more uniform flow of steam and less loss by radiation in the steam pipes if all three furnaces were being operated instead of one. Now, if these main steam pipes were shut off by valves, were shut off so that the steam would pass to the engine only through piping that connects the boilers with the engines operating one furnace, there
402 would be no greater loss by radiation proportionately in operating one furnace than there would be in operating three?

A. No, sir.

Q. You stated that you could get a more uniform flow of gases and better results from the fact that when one furnace was stopped for casting that the gases could then be utilized under the other two furnaces. Is that correct?

A. Yes; I think it is.

Q. Then you think it correct as a proposition that you save in gases, and by running three furnaces at once you make a more uniform flow of gases, and stopping one furnace for casting does not detract anything from the amount of heating fuel that you get from the other two furnaces?

A. Very little. It is hardly noticeable.

Q. Did you say that valves in the main steam pipes would not be necessary or useful where you were running one furnace or not?

A. I don't think they are necessary or useful.

Q. You do not think they serve any purpose in preventing a loss from radiation of the steam pipes?

A. They might, but they will be injurious in the end.

Q. You say you were there when furnace "A" was blown in?

A. Yes, sir.

Q. Didn't Mr. Gordon have charge of everything?
A. No.
Q. Who was in charge?
A. Maj. Doud was in charge of the men.
Q. Was he not acting under Mr. Gordon's directions?
A. Yes, sir.
Q. Then Mr. Gordon was superior in charge?
A. He supervised the blowing in. It was blown in according to his orders.
Q. What sort of coke did he use?
A. I think it was the Pocahontas and Jasper.
Q. What was the difficulties you say you experienced in blowing in furnace "A"?
A. A very hard rain storm that we had.
Q. What effect did this have?
403 A. We commenced the furnace on Saturday, about noon, and it commenced raining Sunday noon. We had it filled up and put the blast on. We ran at first carefully, and were increasing the speed gradually when this rain storm came up. A great deal of the water got into the furnace.
Q. Where did the rain go to?
A. In the top of the furnace.
Q. Is not the furnace closed up?
A. By a bell and hopper, but it is not very tight.
Q. How broad is the furnace at the top?
A. About thirteen feet.
Q. The top was covered with a bell and hopper?
A. Yes.
Q. That is hot, is it not?
A. It was not at that time.
Q. What day did that storm come up?
A. I think Sunday noon. The rain cooled all the pipes and came down on the boilers. The pipes were all exposed.
Q. The only effect that had was to reduce the amount of steam that you got to the engines?
A. Yes, sir.
Q. Didn't you have plenty of engines and plenty of boilers to have gotten plenty of pressure to run the furnaces, notwithstanding the rain?
A. The furnaces were not in the condition to take the pressure, there was so much moisture in it. The class of men that we had never had worked at a furnace before, with the exception of two. They were perfectly green.
Q. What part of the work did these green hands have to do?
A. All parts.
Q. Then what did they have to do?
A. They had to keep filling the furnace after it settled. That consisted in taking the burden up the hoist, etc.
Q. You had an experienced top filler?
A. I don't know. From the way he worked I do not think he had had any experience. I would not judge that he was an ex-

perienced man. The scaleman was asleep half the time. I caught him napping three or four times, and the men running over the scales without stopping to weigh the stuff.

404 Q. What effect did the improper burdening of the furnace have to do with its doing good or bad work in reference to the hard rains?

A. The filling of the furnace got damper with the rains.

Q. Then, that result would have followed whether you had had experienced men or not?

A. No; not if we had had good men.

Q. Then, if the storm had not come up the furnace would have worked all right, notwithstanding you had green men?

A. No, sir; I attributed it to the green men and to the storm. It would have followed without either.

Q. Do you think it would have failed if the storm had not come up?

A. That I cannot say.

Q. Did you analyze the burden before it is put in?

A. No, sir.

Q. Was the slag analyzed afterwards or the iron?

A. Not as I know of.

Q. What do you mean by what an analysis shows?

A. The proper proportion of ores and coke.

Q. Was that improper?

A. I do not know.

Q. You do not know whether that contributed to the failure?

A. It must have. I know that if you fill your furnace according to an improper analysis it will not work well. I do not know whether or not the analysis was correct.

Q. You are undertaking to give an account for the reasons of the failure. You of course draw your conclusions from the data of which you have knowledge. You attribute it to the green workmen and to the storm and not to anything wrong in the analysis?

A. I do attribute it to the analysis.

Q. If you do not know that the analysis was wrong how can you attribute it to that?

A. I do not know it is an actual fact.

Q. Then, according to your judgment, the failure was a result of the storm and the inexperienced labor you had?

A. And to the material that was used.

Q. But you have no knowledge of the analysis whether it

405 was correct or incorrect? You attribute the failure to the inexperienced men and to the storm?

A. Yes, sir.

Q. If the analysis of the ores was correct, then the other two causes were sufficient to produce the result?

A. Not necessarily.

Q. Then, your conclusion is based partly upon what you know were the facts and partly upon the theory that the analysis was wrong?

A. Yes, sir.

Q. Then it is based partly upon facts and partly upon theory?
A. Yes, sir.
Q. That rain storm continued how long?
A. About four days.
Q. How long did it take you to get that charge out of the furnace and get it relieved of and free from those wet materials?
A. I do not think we ever got them out. We worked at it eight days. Don't think we ever got that charge out.
Q. Did you make any castings at all?
A. Yes.
Q. Was anything the matter with the sand in the casting-house?
A. It was about the same we used in number 2.
Q. Did you have any boils?
A. I think we had one.
Q. Boils will result from several things besides sand?
A. Yes.
Q. Little pieces of iron will cause one?
A. It depends upon the kind of iron. A good many little things will cause it; the sand being wet.
Q. Did it not result from breaking iron from one little piece to another?
A. That's very often the result.
Q. You say furnace "B" worked all right while you were there?
A. Yes; the only difficulty that we had was that we could not get the iron pigged by reason of boils in the sand.
Q. You had exactly the same kind of labor that you had in furnace "A"?
A. Pretty much the same.
Q. Then, the labor was not the principal feature in producing the failure in No. 1, was it?
406 A. Yes; I think they got some additional men at No. 2 furnace, but I am not sure. I had nothing at all to do with the men.
Q. You loaded out of the same stock, didn't you?
A. I do not know. We loaded out of the same material.
Q. How long did you stay with furnace "B"?
A. A week or ten days.
Q. You made how much iron?
A. I do not know exactly. I should judge about 100 tons per day, taking into the consideration the boils.
Q. How many boils did you have?
A. There was hardly a cast we didn't have one; some very serious.
Q. About how much iron do you think went into the loss from these boils?
A. About 35 or 45 tons in each cast.
Q. During the ten days how much iron do you suppose was lost by boils?
A. More than half of the whole quantity made.
Q. Don't you know that that was not the reason why Mr. Gordon surrendered control to Mr. Doud?

A. No; I do not know. I was not there at the time.

Q. It cannot be said that faulty sand is an objection in working a furnace, can it?

A. Yes.

Q. That it goes to the construction of the furnace. The furnace is not responsible for that, is it?

A. No. I wish to state that I think the average tonnage was 80 tons instead of 100, as I stated.

Q. I believe you testified that every cast you made for ten days was spoiled by boils, didn't you?

A. I think every cast.

Q. And you think half the iron was lost by boils?

A. Half or over half.

Q. You made 80 tons per day. Then your furnace run out 160 tons per day?

A. No; 80 tons per day.

Q. You say that while furnaces A and B were being blown in Mr. Gordon staid at the plant and was there for as much as 36 hours at a time?

407 A. Yes, sir.

Q. And things were under his general direction?

A. Yes.

Q. Mr. Doud had no superiority over Gordon in blowing that furnace in?

A. I don't know that he had, except in employing the hands.

Q. When they went to blow in the furnace, then Mr. Gordon was supreme, wasn't he?

A. I think so.

Q. How much coal did you use under these boilers during that time?

A. I haven't any idea; don't know anything at all about it.

Q. Did you mean that the storm lasted forty-eight hours or the heavy season of rain lasted 48 hours?

A. It was a storm all the while and rained incessantly for four days.

By Mr. GUNTER:

Q. Did you see furnace "A" opened after it had been abandoned?

A. Yes.

Q. What did it show?

A. Too much limestone.

Q. What did you mean by saying that the analysis must have been wrong of the ores and coke that was given to Mr. Gordon?

A. From the burdening of the furnace; I know very well he would not have burdened a furnace that way from what I have seen of his handling blast furnaces heretofore. I simply ascribe the difficulty to a wrong analysis.

Q. Might it not have resulted in part from his orders not being carried out by the persons in charge of weighing the ores?

A. Yes, sir.

Q. What is the character of Weimer as a manufacturer of engines?

A. He has a very extensive reputation.

Q. His engines are over 140,000?

A. Yes, sir.

Q. This engine is as heavy as his?

A. Yes, sir.

Q. Have you seen furnaces the size of these operated with only two stoves no larger than two of these?

A. Yes, sir.

Q. You think, then, that two of these stoves are ample to operate one furnace?

A. I do.

Q. Have you seen a furnace with only two stoves operated
408 successfully without any apparatus whatever for a surplus stove?

A. Yes, sir.

Q. Were these furnaces in proportion to the size of two of their stoves different from the proportion of these other furnaces and two of their stoves?

A. No, sir; the furnaces that I have reference to have the same size stoves in proportion as those in Sheffield.

Q. How many plants do you know of that are being operated with two stoves?

A. Three.

Q. State whether or not in doing all that brick and foundation work generally in constructing that plant Mr. Doud was particular and careful in exacting of you as to how your work should be done.

A. He was, and was also careful as to the material.

Q. Did he require any changes to be made?

A. Yes, sir.

Q. Suppose there was an excess of gas and one furnace was stopped, would not the heating surface and capacity for burning the gases from the other furnaces be increased thereby under all the boilers?

A. Yes, sir.

Q. In case, then, of a production of an excess of gases from three furnaces one furnace might possibly be stopped and yet the boilers might be supplied with all the gas they are capable of burning, and thus the maximum of heating the steam kept up all the time?

A. Yes, sir.

Q. In the operation of furnace "A" was there not a platform at the top of the furnace, sloping towards the furnace mouth?

A. Yes, sir.

Q. What was the length of that platform?

A. About 25 or 30 feet.

Q. Was it built according to the specifications?

A. Exactly.

Q. You say that it sloped into the furnace?

A. It was on a level with the top of the furnace.

Q. Do you know whether the water from that platform would run into the furnace or not?

A. It would have a tendency to do so.

Q. Whatever run in from that platform would be added to what might fall into the furnace?

A. Yes, sir.

Q. There is a platform around the furnace at the top which
409 is 26 ft. 3 in. in diameter?

A. Yes, sir.

Q. Would the water that fell on that fall into the furnace?

A. Not all.

Q. Any part of it?

A. Some, yes.

Q. And you say that whatever water fell on that and ran into the furnace would be added to what fell into the furnace itself?

A. Yes, sir.

By Mr. WHITE:

Q. As a matter of knowledge of your own, independent of the analysis of the ores that were put in, you determine that there was too much lime in the charge?

A. Yes, sir.

Q. And that that contributed to the failure of the furnace?

A. Very much.

Q. How much—was it a particular factor?

A Yes, sir.

Q. Did it have more to do with it than the rain storm?

A. Yes, sir.

Q. More than any ignorance of the labor?

A. Yes, sir.

Q. Then it was the principal factor?

A. Yes, sir.

Q. Whereabouts have you seen two furnaces where each was operated with two stoves?

A. One in this State; the Alice, at Birmingham; in Missouri, at St. Louis. I suppose I could name a dozen. The Belmont, at Wheeling.

Q. The Belmont is running with two stoves?

A. It was until recently; it may be still.

Q. Do you know the sizes of these furnaces you have named over?

A. No, sir; not positively.

Q. You say that during the construction of this work Mr. Doud examined it and required changes to be made. You mean changes in workmanship and material?

A. Yes, sir.

Q. He didn't undertake to interfere with the design, did he?

A. No, sir; I cannot say he ever did.

Q. Where you have a superabundance of gases you do not have to use coal under the boilers, do you?

A. No, sir.

410 Q. You say that platform is 26 feet in diameter. That includes the diameter of the furnace also?
A. Yes.
Q. Does that platform slope towards the furnace?
A. It is about on a level.
Q. How is it made?
A. It is made with strips underneath.
Q. And the water falls off as well as towards the furnace?
A. No; it will not run off; it has a railing. As much will run off from the furnace as will into the furnace.

411 *Testimony of George Lyell. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

(Copy.)

412 GEORGE LYELL sworn for respondents.

Direct examination by Mr. WHITE:

Q. How long were you engaged at the Cole furnace within the past twelve months?
A. I have been there about ten months.
Q. When did you commence?
A. In October.
Q. What did you do?
A. I began tending water.
Q. That is, with the men managing the boilers?
A. Yes.
Q. Were you on at day or night?
A. One week at day and one week at night; we changed every Saturday at 12 o'clock.
Q. What attention did you give the boilers with respect to keeping them properly guaged with water?
A. I was right there with them all the time, only when I was compelled to stop off for a minute or two, and then the engineer would stay there.
Q. Did you make use of the appliances of the boilers to keep the water regulated to shut it off when it got too high?
A. Yes, sir.
Q. Did you carry the water as near the right point as practicable all the time?
A. Yes, sir.
Q. Did you ever have any employment in reference to boilers before anywhere else?
A. Yes; but not of that kind.
Q. With what kind?
A. With locomotive boilers and stationary-engine boilers.
Q. What do you call stationary-engine boilers?
A. Saw-mill boilers, etc.

413 *Testimony of Wm. S. Jones. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

(Copy.)

414 WM. S. JONES sworn for defendants.

By Mr. WHITE:

Q. Did you held any position with the Alabama & Tennessee Coal & Iron Co. during the time these furnaces were being constructed?

A. Yes, sir; I was secretary of that company.

Q. Did you have charge of the payment of these excess freights that arose under that contract?

A. Yes, sir.

Q. It was your duty to adjust them as well as pay them?

A. Yes, sir.

Q. These bills were rendered by whom?

A. By Mr. Gray, the Southern agent of Gordon, Strobel & Laureau.

Q. What was the amount of excess freights over 13½c. that was rendered you?

A. I cannot tell you that.

Q. Cannot you approximate it?

A. Yes, sir; I think Mr. Gray's statement of $9,600 is about correct. In this connection I would state that I did not recognize Mr. Gray's account at any time because they were incorrect. I made my own figures from the bills he rendered me. I took these bills and found so many inaccuracies that I declined to recognize them. I do not mean that he made any clerical errors in his calculations. There were probably 1,000 to 1,500 bills that passed through our hands and I do not think there were exceeding three bills in which his calculations were in error.

Q. Were there any charges or not rendered you by Mr. Gray as excess freights that accrued between Cincinnati and Sheffield?

A. Yes, sir.

Q. What was the aggregate amount and state what they were?

A. There were charges claimed that accrued beyond Lexington, Ky., and Cincinnati, Ohio.

Q. Was that the only error?

A. Yes, sir.

Q. What else?

415 A. Transfer charges at Cincinnati or $5 per car, and charges on same items from Philadelphia to Sheffield all came back on us as excess freights.

Q. What was the aggregate amount of such items?

A. It was $2,504.54.

Q. What amount does that leave?

A. $7,113.62.

Q. Then what was the amount of excess freights that they were entitled to?

(Objections as to what they were entitled to.)

A. $7,113.62.

Q. How much was paid?

A. $6,900.00.

Q. What balance was left either way?

A. $213.62 due them.

Q. In your adjustment what charges beyond the excess freights did you embrace?

A. I embraced all over 13½c. between Cincinnati and Sheffield.

Cross-examination by Mr. GUNTER:

Q. You did not embrace any items of getting cars from one point in Cincinnati around to the railroad running out this way?

A. No, sir.

Q. You did not consider that, then? Your company was under obligation to pay them?

A. No, sir.

Q. You did not know what that amounted to?

A. No, sir; it would be impossible to tell.

Q. In shipping freights you were connected with the Louisville & Nashville R. R. Co.?

A. No, sir; never in my life.

Q. You know what bills of lading were issued from Cincinnati to all points in the South?

A. Yes, sir; that was customary.

Q. The item which you rejected was an item of freight which originated in making connection between other roads from Cincinnati?

A. The items that I rejected were charges that were made beyond Cincinnati proper.

Q. Lexington is this side of Cincinnati?

A. Yes, sir.

Q. You state that the items you rejected were those beyond Cincinnati proper?

A. Yes, sir.

416 Q. You rejected an item of freight which connected two lines through Cincinnati—transfer charges?

A. Yes, sir. But beyond Cincinnati some material was shipped to Cincinnati and charges advanced by the railroad company, and they were billed on to Sheffield and at Sheffield the whole bill was paid. I rejected everything except the 13½c.

Q. Did Mr. Gray ask you to pay the freight beyond Cincinnati?

A. Yes, sir; in more than one case.

Q. They amounted to how much?

A. I think it would be impossible to say.

Q. Was it more than $100?

A. I think it was.

Q. What was your best judgment?

A. I have no judgment; I cannot depend on my memory.

Q. What is your best opinion?

A. I have no recollection.
Q. There were some freights beyond that point?
A. Yes, sir; those letters explain that.
Q. That Lexington matter, don't you know how much that was?
A. I do not know how much. At one time there was a break in the railroad between Cincinnati and Louisville, and they could not get freight through. Gordon, Strobel & Laureau induced Mr. Culp to ship freight from Lexington instead of Cincinnati, at the same rate to Sheffield. We did not consent to guarantee that rate until Mr. Culp agreed to protect us. The excess freights from Lexington amounted to the same thing as from Cincinnati.
Q. You took that as the same?
A. Yes, sir; we treated Lexington the same as Cincinnati.
Q. How long were you connected with the Alabama & Tennessee Coal & Iron Co.?
A. From March 5th, 1887, to the present time.
Q. You are still secretary of that company?
A. Yes, sir.
Q. Is that company still doing business?
A. It is in the hands of a receiver.

By Mr. TOMPKINS:

417 Q. You say Lexington is this side of Cincinnati; do you mean to say that Lexington is on the route of the Louisville & Nashville R. R. from Louisville, over which its freights come?
A. No, sir; I meant to say that Lexington is another point on the L. & N. system, which they substituted for Cincinnati because of a break in the road.
Q. I understand you to say that, as secretary of this company, charged with the adjustment of this 13½c. rate, that you allowed Mr. Gray, as representative of Gordon, Strobel & Laureau, all excess freight that the L. & N. R. R. charged over 13½ from Cincinnati to Sheffield on all material that went into the construction of these furnaces.
A. Yes, sir.
Q. And that you declined to allow any excess-freight rate that was charged from any other point or for carrying cars from any other line of railroad except the L. & N. through Cincinnati to Sheffield?
A. Yes, sir.
Q. And that you stated that all that they were entitled to of this excess-freight rate, except about $213, was paid to Mr. Gray as representative of this firm under this adjustment?
A. Yes, sir.

By Mr. GUNTER:

Q. Do you know the total payments you made?
A. $514,500.
Q. That included the $6,900 paid on freights?
A. Yes, sir.

By Mr. BRICKELL:

Q. You do not mean to say that Mr. Gray consented to that settlement?
A. No, sir.
Q. Did he not all the time claim these transfer charges which he paid in Cincinnati?
A. I do not think he did until after six months.
Q. Then, after the contract had run six months, he discovered them and did claim them?
A. Yes, sir.

(It is admitted by counsel for petitioner that the transfer in Cincinnati was for the transfer of cars from the depots of other roads to the depots of the Louisville & Nashville R. R.)

Mr. JONES: The transfer charges were not more $200 or $300.

WM. S. JONES.

418 *Testimony of C. H. Mann. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

419 CHAS. H. MANN sworn for plaintiff.

Direct examination by Mr. GUNTER:

Q. You have been engaged in working at the furnaces in question?
A. Yes, sir.
Q. What's your business?
A. A machinist.
Q. By profession?
A. Yes, sir.
Q. Served an apprenticeship?
A. Yes, sir.
Q. Are you familiar with the inlet and outlet valves to the blast cylinder in these engines?
A. Yes, sir; I have put in a number of valves and took a part of them; most of the time I was working in the shop.
Q. Do you know how they operated during Mr. Doud's administration?
A. Yes, sir; they worked fine.
Q. They were tight?
A. Yes, sir; perfectly tight.
Q. As a machinist state whether or not this kind of valve does not have to be occasionally taken out and replaced.
A. Yes, sir; they do.
Q. It is the natural result of working them that they have to be replaced?
A. Yes, sir.
Q. Were these good valves in the first instance?
A. They were.

Q. Did you ever see any better?
A. No, sir.
Q. They were as good as the nature of the work would admit of?
A. Yes, sir.
Q. You say they were tight when Mr. Doud was operating the furnace?
A. Yes, sir.
Q. If the valves were all tight and there were no leaks in the pipe conducting the blast to the furnace all of the air blast would go into the furnace, wouldn't it?
A. Yes.
Q. If these valves were not tight either in the inlet or outlet valves, or both, or if there were leaks in the mains conducting the cold blast to the stoves or in the stove or in the stove valves, would it not require a greater pressure to get a given quantity of air into the furnace?
420 A. Yes, sir.
Q. And the result might be a sucking back and forth of the same air to a large extent?
A. Yes, sir.
Q. When Mr. Doud operated that furnace how many engines did he run?
A. Two was all that we ever used.
Q. Did you find them sufficient?
A. Yes, sir.
Q. Did you have charge of the engines then?
A. Yes; of furnace 8.
Q. Did you have any thumping in the engine then?
A. When they would get water in them while they were stopped I would pump it out.
Q. You mean that you would not allow a full stroke of the engine until the water was out?
A. Yes, sir.
Q. You would work the engine backward and forward until you got all the water out and then you would let the piston make a full stroke?
A. Yes, sir.
Q. What do you say of the propriety of stopping these engines when they are at full speed by simply uncoupling them?
A. It is a great strain on the engine all over.
Q. Did you ever see that done at these furnaces?
A. Time and again.
Q. Who was in charge of the furnace at that time?
A. I suppose Mr. McIlwaine or Mr. Chamberlain; I don't know which. Mr. Doud never let them be uncoupled.
Q. Did you ever see engines of that magnitude treated that way by competent engineers?
A. No, sir; I never did.
Q. At any time did you see those engines started in the way you have just described and discovered any hammering of water during its operation?

A. I saw Albert Boyd start them one Saturday night at casting time. I actually was afraid to stay in the room. She hammered some three or four minutes before she relieved herself of the water. After she did she went all right.

Q. How did it relieve itself?

A. Through the exhaust.

421 Q. Did that engineer pay any attention to the hammering?

A. No, sir.

Q. What did he do?

A. He was up fooling with another engine.

Q. How ought these engines be started and stopped?

A. First, the blast throttle ought to be shut down, and that shuts off the steam; but the valves stay open, so that there can be no hammering.

Q. How ought they be started?

A. They ought to be unhooked and started slowly.

Q. By that operation it does not make it- full stroke?

A. Yes it does, unless you back it out.

Q. This apparatus for uncoupling the engine can be used and is intended to be used for letting steam into the piston at any time of the stroke on either side, so that you can make half a stroke and then go back?

A. Yes.

Q. So that when water is in the cylinder it has to force itself out through the waste-cock?

A. Yes, sir.

Q. When you were running these two engines under Mr. Doud's administration how many batteries of boilers did you use?

A. We used two a good while, but the furnace worked badly two or three days and we put on three.

Q. What quantity of coal did you use during that time?

A. I do not know exactly how much. I was busy watching other things and did not pay much attention to it.

Q. Do you know how the joints were made in the main steam pipes at these furnaces?

A. Yes, sir. I made the biggest portion of them.

Q. Are they all made in the same way?

A. Yes, sir.

Q. Have they given any trouble?

A. Not particularly.

Q. Were they covered before you started up?

A. No, sir.

Q. As a machinist do you believe these joints would have given any trouble if covered at the start?

A. I do not.

422 Q. What could break a bed plate of one of these engines in the operation of a furnace?

A. Unhooking them with a full headway of steam on. Where water is in the cylinder in great quantity this heavy pounding would break it.

Q. If the engines are well taken care of and properly run and

there is never any lifting weight upon them in excess of the moving parts of the engines would there be any strain at all upon the bed plates?

A. No, sir.

Q. Suppose that in running an engine of that kind you had a heavy pressure pulling up against the piston as it went down and the engine was going rapidly and you should have on an excessive lead of steam down below, what would be the effect of that?

A. It would cause it to break the bed plate quicker than any other place.

Q. Would it tend to lift the shafting; and if the caps were lifted up it would come down on the bed plates?

A. Yes, sir.

Q. Suppose there was nine pounds blast on that engine and the moving parts of the engine weighed thirty or thirty-two tons and there was no lead upon the engine, state whether or not there would be any pounding then.

A. You can give the engine too much or not enough lead.

Q. Suppose there was not enough, would there be any pounding?

A. No, sir.

By Mr. WHITE:

Q. Where are you working now?

A. At the Ensley furnace.

Q. Who is in charge of the Ensley furnace?

A. Mr. Doud.

Q. How came you to come up here?

A. I was summoned.

Q. By whom?

A. By one of these gentlemen. I got a telegram.

Q. Who signed it?

A. I do not know.

Q. Didn't you read it?

A. No; Earl Doud brought it to me.

Q. What did he say?

A. He said they wanted me up here in haste.

Q. Who said so?

A. Earl Doud.

Q. Who did you think sent it?

423 A. I didn't know. I supposed it was from the Major.

Q. Didn't you know that?

A. No, sir.

Q. You were not informed?

A. No, but I think it was.

Q. Your idea is that he had it done?

A. Yes, sir.

Q. How long was Doud in charge of the Cole furnaces?

A. I went to work for him, I think, on 10th June, and worked on up — the 1st September, and went home sick and came back and worked about six days and went to the Ensley furnace.

Q. Then the time you were a machinist after the furnace was in operation was six days?

A. No; I was there all the time.

Q. How long were you with Doud at the Sheffield & Birmingham C., I. & R'y furnaces?

A. As long as he was there.

Q. How long was that?

A. I suppose two months.

Q. Do you think he was there two months operating that furnace?

A. Yes, sir.

Q. When was furnace "B" blown in?

A. I could not name the date.

Q. About 7th September?

A. I could not say; in the early part of September.

Q. Then Mr. Gordon was in charge about ten days before Mr. Doud took charge?

A. I could not say.

Q. Doud di-n't take charge of these furnaces until about 15th September?

A. I could not say.

Q. Then Doud went out of the management about 20th October?

A. I could not say exactly when.

Q. Then he was in charge about a month?

A. I do not know.

Q. What time of the month was it that you left the Cole furnaces *and* go to the Ensley?

A. I do not recollect.

Q. Did you quit the same time Doud did?

A. I staid four or five days longer than he did.

Q. Then the furnace had not been running more than six
424 weeks or six months when you quit?

A. No, sir.

Q. You say you repaired several valves in the engines during that time?

A. Not a great number; I don't remember exactly how many.

Q. You had to take them out on account of shrinkage?

A. No; it was because the leather was wet.

Q. Which valves are leather, the inlet or outlet?

A. I think they have them in all.

Q. One was brass, wasn't it?

A. Except with one engine, which had leather all the way through.

Q. You did not repair the valves in but one engine?

A. No, sir.

Q. You did not repair but one?

A. I suppose I repaired eight or nine.

Q. You think these are the best valves that are made?

A. Yes, sir; they are number one valves.

Q. How many valves in these engines?

A. I did not count them.

Q. There are two kinds of valves?
A. Yes, sir.
Q. These valves that you took out were in need of repairs on account of cracks in the leather?
A. Yes, sir.
Q. Were they not likely to get out of fix?
A. Yes; in the course of time.
Q. They don't wear out in six weeks, do they?
A. Some do.
Q. Some last six months, don't they?
A. Not many.
Q. You have used the gun valve?
A. No; I have seen them, but never used them.
Q. When the valves leak or get out of fix they repair them, don't they?
A. Yes, sir; take them out immediately.
Q. All machinists and engineers apply that remedy, don't they?
A. Yes, sir.
Q. Can you always tell when the valves leak?
A. Yes, sir.
Q. How?
A. You can always tell by the heavy pounds in the blowing tubs.
Q. Suppose it shrinks all around equally, then can you tell?
A. You can if it shrinks enough.
425 Q. When was it you saw Albert Boyd stop that engine up by uncoupling it?
A. One Saturday night at casting time. I do not know the date. I was there talking to him.
Q. That is the way he stopped the engine at casting time?
A. Yes, sir.
Q. Which engine was it he stopped?
A. I do not know exactly; one in the center of the house.
Q. Then what did he do with the other two?
A. He went on *s* starting them and I went on out the door.
Q. You could not undertake to look to see which engine it was?
A. I am not positive. It was either the third or the fourth engine.
Q. It caused pounding?
A. Yes, sir.
Q. How long had the engines been stopped?
A. About twenty or twenty-five minutes.
Q. Does it take that long to cast?
A. Sometimes it did.
Q. The average time is ten minutes, isn't it?
A. I could not say.
Q. Did he have the cock open at the bottom of the cylinder?
A. I could not say.
Q. Will enough water form in the cylinder during the time stops are made for casting to prevent its discharge by the waste cocks, if it is open?

A. I do not suppose it would. He probably had it shut. If he had had it opened it could not have formed in that short while.

Q. You heard this heavy pounding?

A. Yes, sir.

Q. You say the result of starting an engine that way is to strain it all over?

A. Yes, sir; it is dangerous.

Q. Suppose starting the engine that way fails to result that way, does it destroy to any extent the power of that engine?

A. No, sir.

Q. Did that pounding produce any result that you saw?

A. Not at that time.

426 Q. You say it lasted three or four minutes?

A. It must have been; I turned and got out.

Q. Was it four minutes? You could walk to the Huntsville hotel in 2½ minutes, couldn't you?

A. I suppose in about four.

Q. Then you think it was three minutes, anyhow?

A. Yes; I think it was.

Q. Was not that a long time for such as that to happen? A man gets mixed up at excited times.

A. Yes; I suppose so.

Q. Might it not have been three or four seconds?

A. It was longer than that.

Q. He did not seem to notice it?

A. He did not notice it.

Q. Is that the only time you saw these engines started that way?

A. I have seen them started that way frequently.

Q. When were some other times?

A. I often noticed them started that way, but did not pay any attention.

Q. It is a practice that you never see a good engineer do?

A. Yes, sir.

Q. Q. Partlow was a first-rate man?

A. Yes, sir; he staid in my place when I was sick.

Q. Did you ever see Partlow unhook an engine that way or the man who was running under him?

A. No; I never saw him.

Q. May it not have been that the engines were hooked up *there* way while you were there?

A. No, sir; I do not think so.

Q. Was not the opportunity offered a man to have hooked them up just the same as it would have been while Partlow was there?

A. No; it was strictly against orders.

Q. Don't you know it was against Chamberlain's or Partlow's orders?

A. I do not know.

Q. A man running the engine can deceive the man in

427 charge about such things while he is not there?

A. Yes, sir.

Q. Then it might have happened under your administration while you did not know it?

A. I do not think it could. I would have caught on to it after awhile.

Q. What would have enabled you to catch on to it?

A. Some of the hands would have been speaking of it.

Q. Then it might have happened while you were there?

A. Yes; it might. A man working around a furnace cannot be in the engine-room all the time.

Q. You have seen any quantity of engines thumping, haven't you?

A. Yes.

Q. It is a result that happens some time or another, don't it, in almost all furnaces from some cause?

A. Not all furnaces.

Q. You have seen a furnace where it was free from such results?

A. Yes; for a time.

Q. You are very apt to have thumping from some cause or other?

A. Yes, sir.

Q. Then it is not unusual when you have thumping, is it?

A. No, sir.

Q. How big was the exhaust to that cylinder?

A. I did not pay any attention. I was busy in the shops.

Q. You were in charge and cannot tell the size of the exhaust?

A. I did not pay any attention.

Q. What is the usual size?

A. About 6 in. in diameter.

Q. You mean that there is an opening six inches in diameter for the water to escape that gets in while the engine is not working?

A. It has to go through a valve $1\frac{1}{2}$ to $1\frac{3}{4}$ inches before it gets through.

Q. You say you ran two batteries of boilers?

A. Yes. Part of the time we had three.

Q. What did you run three for?

428 A. The furnace was running bad and we did not get much gas and had to put on another battery.

Q. At what revolution did you run these engines with two batteries?

A. About thirteen to each engine—sometimes more or less. They would sometimes run up to 20 or 22.

Q. After you had the furnace in operation at what did you run them?

A. I do not know. Sometimes they ran at 20 and 22.

Q. Would not they run them up as high as 27 or 30?

A. I could not say. I don't think they did.

Q. You could not get steam enough from two batteries to run the engines to that stroke?

A. We had steam enough, but we did not have the pressure.

Q. You never ran but two engines?

A. No, sir.
Q. You never ran three?
A. Sometimes we changed engines, but we never ran three at once.
Q. If the lead on these engines were proper there would be no pounding resulting from an improper lead?
A. No, sir.
Q. There was no pounding from that cause while you were there?
A. No, sir.
Q. What was the lead when you were there?
A. It was $\frac{3}{8}$.
Q. Who put it there?
A. Mr. Gordon.
Q. You did not change it afterwards, did you?
A. I never touched it.
Q. So far as you know it is that now?
A. I could not say.
Q. Albert Boyd was discharged, was he not?
A. I do not know whether he quit or was discharged.
Q. How long was he there?
A. I do not know.
Q. You do not know that he was discharged nor what he was discharged for?
A. No, sir.

429 By Mr. GUNTER:

Q. This thumping from water being in the cylinder is not a usual or common thing with engineers, is it?
A. Not common.
Q. It never will happen with good management, will it?
A. No, he will pump the water out before he starts.

430 *Testimony of Henry B. Tompkins.*

EXHIBIT H. Filed in clerk's office July 19th, 1890. A. W. McCullough, clerk.

431 HENRY B. TOMPKINS recalled for respondents.

Direct examination by Mr. WHITE:

Q. You made a statement on your direct examination in reference to the use of scrap iron by Mr. Doud, and stated that you did not know whether any had been used by him or not?
A. I do not think I said that none had been used by him. For the 28 days he was in charge of the furnace I saw a good deal of scrap iron, some thrown out by the side of the furnace and the other taken and put in the stock-house, and Mr. Doud stated to me that that scrap iron that was being put back in the stock-house was to be put in the furnace and run over again. Just what proportion of the scrap iron made was thrown out by the side of the cast-house

and what proportion was put back in the stock-house I do not know, but I know that some of it was put back in the stock-house for the purpose of being used in the furnace.

Q. Was there any dissatisfaction on the part of any of the officers or employees of the company in relation to Mr. Gordon's management of the furnace "B" besides yourself?

A. Yes, sir.

Q. Who was it?

A. Mr. Doud.

Q. He was superintendent in charge?

A. He was superintendent. I did not consider him in charge so long as Mr. Gordon was in charge.

Q. He was an officer of the company?

A. Yes.

Q. What were Mr. Doud's complaint- of the manner of Mr. Gordon's management of that furnace?

A. Mr. Doud stated to me about the time the first furnace was abandoned that Mr. Gordon has made a mistake in blowing in that furnace, that he had blown it too hard and had burdened it too heavy, and criticised Mr. Gordon very severely. He attributed that to a great extent to Mr. Gordon's improper management.

Q. In what condition did he report No. two furnaces after Mr. Gordon left?

A. He stated to me that it was in very bad condition and he doubted very much his ability to bring it around, as he
432 called it; that *that* it was very much in the same condition as the first, for the reason that Mr. Gordon had not only blown it in too hard, but he had also burdened it improperly, and he told me furthermore, after he had charge of the second furnace, that he changed the burden because he thought Mr. Gordon was having it burdened improperly. Mr. Doud stated to me that he had discharged fully his duty of having everything in readiness and everything properly analyzed for Mr. Gordon and, that the condition of everything was proper and right at the time Mr. Gordon took charge of both furnaces to blow them in. I will state further that Mr. Doud was very anxious to blow in the first furnace and was very anxious that Mr. Gordon should not do it, because he wanted to make a reputation, and stated he could blow it in properly and was certain he could do it. Mr. Doud was equally anxious to blow in the second furnace, and said that he was certain he could blow that in all right, although Mr. Gordon had failed with the first. I told him he could do so if he would consult Mr. Chamberlain, who was an employé of the company. This he declined to do, and I stated to him that he would have full control and that I only wished that he consult and advised with Mr. Chamberlain, but he declined to do it, and I arranged with Mr. Gordon to blow in the second furnace.

Cross-examination by Mr. GUNTER:

Q. You say that Mr. Doud refused to blow in that furnace under the advice and consultation with Mr. Chamberlain?

A. I did not say so; I stated he refused to advise and consult with Mr. Chamberlain.

Q. That is the reason that he gave for not blowing it in?

A. He did not give any such reason for not blowing it in, but I took the position that he should not blow it in without consulting with Mr. Chamberlain.

Q. How long have you known Mr. Doud?

A. About three years, I think.

By Mr. WHITE:

Q. Do you know of Mr. Doud's reputation as a practical iron-man?

433 A. I do.

Q. What is it?

A. Very bad, except as a furnace-builder.

By Mr. GUNTER:

Q. You did not say anything about Mr. Doud's reputation.

A. I did not because I was not asked anything about it. I did say that, so far as I knew, he was competent, but I said I knew nothing about such matters except information I gained from others.

Q. Do you know which furnace in Sheffield is doing the best work now?

A. I do not.

Q. Haven't you an idea?

A. I have none in the world.

By Mr. WHITE:

Q. What condition did Mr. Doud report that furnace to be in when you turned it over to Mr. Chamberlain?

A. He said it was in a very bad and unsatisfactory condition, and said that probably it could be brought around, but he was doubtful about it still; that it was in much better condition than it was when he took charge, but still not what it ought to be.

HENRY B. TOMPKINS.

434 *Testimony of D. A. Tompkins. Filed in Clerk's Office July 19th, 1890. A. W. McCullough, Clerk.*

435 Testimony of D. A. Tompkins, a witness for the defendant in the case of Gordon, Strobel & Laureau *vs.* Sheffield & Birmingham Coal, Iron & Railway Company *et al.* by intervention in the case of Central Co. of New York *vs.* Sheffield & Birmingham Coal, Iron & Railway Co. *et al.*, such being taken under a commission issued from the United States circuit court for the northern district and northern division of Alabama, at Huntsville, by authority of master in chancery, D. D. Shelby, Esq., and taken before George S. Lowman, commissioner duly appointed as aforesaid, in the city of Atlanta, State of Georgia, on the 7th day of October,

1889, the following testimony of said D. A. Tompkins being delivered on oath after he had been duly sworn by said Geo. S. Lowman, commissioner.

436 Direct examination by Mr. HENRY B. TOMPKINS:

Q. Where do you live?
A. At Charlotte, N. C.
Q. What profession or employment are you engaged in?
A. Engineering business and dealing in machinery.
Q. Did you ever receive any technical or scientific education?
A. I have.
Q. Where?
A. At the Rensselaer Polytechnic Institute, Troy, New York.
Q. Have you ever had any experience in blast-furnace building or blast-furnace operation?
A. I was employed by the Bethlehem Iron Co., which owned about ten furnaces. I made the drawings for three or four of them when they were constructed in the capacity of head draughtsman or assistant head mechanic, and did work about furnaces about seven or eight years.
Q. When was that?
A. From 1875 to 1880. I was not employed specifically in connection with blast furnaces, but had work to do in connection with them or iron-rolling mills or any other department where I was called upon.
Q. Are you an expert in the matters connected with machinery, boilers, and engines?
A. I have had a large amount of experience in them, and I suppose in what would be called an expert I am an expert. I do not know just what would be covered under the name of expert. That has been my special occupation ever since I graduated.
Q. What?
A. Machinery, in the service of the Bethlehem Iron Co., and since then I have been constructing steam-power plants.
Q. Do you know anything about the boilers that are constructed by the Babcock & Wilcox Co.?
A. I never had any experience with them all. I know generally the construction of them.
Q. Do you know anything about the tubular boilers and their construction?
A. Yes; I have used a great number of them.
437 Q. In what respect do these tubular boilers differ from the Babcock & Wilcox boilers?
A. In one case the heat is applied inside of the tubes and in — other the water is supplied outside. The tubular boiler has a large shell and the Babcock boiler has no shell at all. There are very great points of difference.
Q. Which, in your opinion as an expert, is the best boiler?
A. In connection with boilers with which I have had no experience of course I can have had no opinion in general. You take a

general class of sectional boilers, of which the Babcock is a type, and my experience with them has not been good. I used boilers of that type and found that they did not turn the water into gases and steam, but that there was a great deal of water contained in the steam from sectional boilers that was suspended water. Whether this is the case with my Babcock boilers I do not know, but it has been my experience with several sets of boilers of that type.

Q. Are not the objections you mention you state to the boilers of the general type to which the Babcock boilers belong? Do not these objections apply to the Babcock boilers necessarily from their construction?

A. As a matter of fact I have never made a test of them and could not say whether they apply or not.

Q. Do you know about their general construction?

A. Yes.

Q. From that knowledge what is your opinion of them?

A. It is that they are not as good a steam boiler as the tubular, but the Babcock people claim that they have some features that overcome many difficulties with many other sectional boilers.

Q. You do not know, though, whether that claim is well founded or not?

A. No, sir; I do not.

Q. Have you ever seen the boilers and engines of the three furnaces at Sheffield, which belong to the Sheffield & Birmingham Coal, Iron & R'y Co.?

A. Yes.

Q. Have you ever seen them when one furnace is in operation?

438 A. Yes.

Q. Do you remember what number of boilers it took to operate one furnace?

A. I do not remember.

Q. Do you remember what number of engines it took to operate one furnace?

A. I do not.

Q. How long since you saw this furnace at work?

A. I do not remember that; probably about a year ago.

Q. You did not go over there lately to examine them for the purpose of testifying in this case?

A. I did not.

Q. Did you notice any special or large amount of water coming from the escape pipes?

A. I did.

Q. To what did you attribute that?

A. Because of the fact that there was wet steam. Just why the steam was wet I did not make any test, but it was either due to the steam pipe or the engine.

Q. Then this large amount of wet steam is occasioned by imperfections in the boilers, the engines, or steam pipes?

A. Yes; or possibly to the three.

Q. So it may belong to all three in connection or to one or two?

A. Yes, sir.

Q. Suppose there were 300 ft. of 12-ft. steam pipe from the boilers to the engines, would there not be a large amount of condensation?

A. There would in uncovered pipes. The steam pipes can be so arranged that you can carry steam a great distance without condensation.

Q. Do you remember or not whether they were covered when you saw them?

A. I do not remember. I had no interest and was there without any special purpose and did not impress any details upon my mind at all.

Q. Suppose that over a series of batteries of boilers there was a steam pipe, say, 100 ft. long, and another one the same length in the engine-house, and these two pipes were connected by three 12-in. pipes, and suppose you were running only one furnace, would
439 there be any advantage in having steam valves in these steam pipes, so as to shut off those you were using and only use enough, say, for one furnace?

A. I would not consider it very important to have such valves.

Q. Would there not be without these valves a large amount of water, judging from the amount you saw when you were there, going to one engine, or enough to make it a serious matter so far as operating with the engines is concerned?

A. Where you have a system of steam pipes arranged for three blast furnaces and operating only one, then to have all steam pipes necessary for the whole three filled with steam while you are operating one you are liable to have water accumulate in that portion of the pipes which is not necessary for one furnace, and then at some one time get at once into the engine and possibly break the engine. This is besides the detrimental effects of general condensation in this part of the pipes not necessary for the operation of the furnace.

Q. Supposing that you had a set of pumps, for instance, at the river, at Sheffield, and another set at the pump-house near the engine-house, and a set of feed-pumps for feeding the boilers in the engine-house, all connected with this main system of steam pipes, would there be any advantage to have a separate steam connection directly with the boilers where we consider there are no valves in this general system of pipes?

A. I would consider it very important.

Q. Why?

A. It gives a flexibility in the operation of the plant, which you have not got and which is very essential in the operation of a blast furnace. I want my set of pumps entirely free and independent. It may require two or three days to repair the damages done for the lack of a half hour's water supply.

Q. You are familiar with the manner of building upright blast-furnace engines?

A. Yes, sir.

Q. You know the character of them?

A. I have designed a great many and am very familiar with them.

440 Q. With a blast-furnace engine with 36-in. steam cylinder and 84-in. blast cylinder and four-foot stroke, with a supposed ability or capacity to run 45 revolutions, with ten pounds pressure of blast, would you consider four 2-in. holding bolts sufficient to hold it firmly to the foundation?

A. No, sir.

Q. Supposing that the bed plate was resting on the foundation in some parts and others were half an inch above the foundation and backed with iron filings, and they, for any cause, should become worked out, what would likely be the effect of running that engine that fast and with that much pressure on the bed plate and foundation?

A. It would depend upon the dimensions, which I have not before me, what my answer to that question would be.

Q. Supposing that that bed plate was six feet wide—ten feet wide, and the holding bolts were in each corner of this bed plate, what should be the result?

A. It is very difficult to answer on account of the absence of data. I could figure what the result would be, but I do not think I could answer it off-hand. The bed plate might or might not be strong enough to resist the strains, but whether it is or not would depend upon its cross-sections and shape. The only way to answer that question would be to get its exact dimensions and the strength of the dimensions in it.

Q. Supposing that, in operating an engine of that kind, the bed plates broke either from force that would break the too first, what would be your opinion as to the cause of that break?

A. It might be that the bed plate was too weak or that there were insufficient foundation bolts to hold it properly or some undue strain of the engine itself. No part of machinery breaks unless there is good cause for it or overstrain.

Q. If an engine bed plate should break in that way and an engineer standing at the bed plate with his foot on it, could anything inside of the engine cause it and his not knowing what it was?

441 A. No, sir, and the only thing that could cause it would be water, and if water should come from the pipes into the engine it would make a very great noise.

Q. Would the lead cause any such strain as to break the bed plate?

A. No, sir; if there were more lead than necessary the piston would force the steam back through the pipes if the engine was built as strong as it should be.

Q. Can you conceive of anything that would break the piston head of the blowing cylinder unless there was some hard substance inside the blowing cylinder?

A. There might be defective casting.

Q. Then if it were to break you would infer that it was from a defective casting?

A. Either that or that some hard substance had gotten behind it.

Q. They use springs, do they not, inside the blowing cylinder and bolts to set these springs out, so as to make them tight?

A. They do it frequently.

Q. Would you consider ¾-inch screws sufficiently strong to set out the springs in the blowing cylinder and steam cylinder and to hold them there?

A. That is a very light spring for an elliptic spring.

Q. Do you consider it good practice to put in one-inch borings under a bed plate of that character?

A. I should say ⅞ to ⅞ inch was good practice.

Q. Suppose you started an engine off at a speed of 40 revolutions, and there was no resisting force in the blowing cylinder, would that have the effect to tear the engine to pieces?

A. It should not, running empty, no more than running a locomotive empty on a railroad.

Q. Then you think the strain would not be very serious?

A. It should not; no, sir.

Q. Have you ever examined blast furnaces where there was a series of them together—three or four?

A. Yes.

Q. Did you ever see those that were connected with a bridgeway from one to another so that you could go from the top of one to the other?

442 A. Yes.

Q. For instance, at three furnaces you were running the middle one and the hoisting engine should give away would you consider it any convenience to have a bridge connecting with the other furnace so that you could use the hoist of another while you were repairing this one?

A. I do not think it would be of any convenience; it used to be considered important, but I do not think it is now. The breaking of a furnace can be repaired easily in half a day, and you can bank your furnace easier than you can run two furnaces with one hoist; a hoist is built for one furnace only, and you would interfere with both by trying to run two furnaces with one hoist.

Q. If the furnace were running badly and slipping it would be very serious, would it not, to stop half a day?

A. Yes.

Q. And in that case it might be of some convenience and might possibly save the furnace if you could keep it going without being obliged to stop?

A. My experience is that a furnace is not liable to stop if properly equipped within itself long enough to damage itself. It is necessary to have your valves perfect and everything flexible so that you are dependent upon an adjacent furnace.

Q. Supposing you had a horse power of 316 and had two blast engines of the dimensions I have given you and it was necessary to run them 40 to 45 revolutions with 8 to 10 lbs. blast pressure, would that 316 horse power of boilers be sufficient to do it?

A. Horse power of a boiler is a very uncertain term. How many sq. ft. of heating surface do you count as a horse power?

Q. Supposing it was counted at eleven?

A. I do not think it sufficient to run the engine.

Q. Supposing the system of steam pipes about which you spoke were all well covered and the proper amount of valves put in them and still it was found by actual experience that it took 2½ to 3 batteries of boilers and three engines to run one furnace and it
443 took 500 lbs. of coal under the boilers in order to make steam enough for each ton of iron made, and that there was still a large amount of water from the escape pipes, and that his furnace plant had six batteries of boilers of two boilers to each battery and seven engines designed for running the three furnaces at once, under these circumstance what would be your opinion as to the boiler power and the engine power?

A. A properly constructed blast furnace plant, properly operated, that used ores that are found both in the North and in the South, should make sufficient gas to make sufficient steam to blow the air to run the furnaces. I could form no opinion as to where the difficulty was.

Q. Suppose the coke, ores, and limestone were of the average quality and that the management wau skillful and that it still took the amount of engine and boiler power that I have indicated to operate one furnace, where, in your opinion, would be the trouble?

A. I should infer that the boilers were of less capacity that they should be; neither were doing their work easily.

Q. If the furnace plant were properly constructed and one furnace in operation, properly operated, ought it not to generate sufficient gas to save the use of anything but a small quantity of coal under the boilers?

A. Yes, sir.

Q. Have you any knowledge of furnaces, modernly built furnaces, being operated with any considerable quantity of coal consumed under the boilers to make steam?

A. No; I do not. They generally run on about the gas the furnace makes. Sometimes, when the furnace is sick, they have to use some coal, and when the furnace is in a prostrate condition they have gas to spare. That would depend upon the character of the ores, the management, and everything else, as well as the construction of the furnace.

Q. Suppose the furnaces were properly constructed, all three of them—the whole plant—would there be any difference in the quantity of gases *pro rata*, if all three furnaces were running or if only one or two?

A. No; if they were of the same size and design, using the same ores. There might be a little difference, depending upon the
444 physical condition of the furnace at any one time, but the average should be the same.

Q. You mean that a plant of three furnaces of the same size, that one should be operated and make its proportion of gases just the same as if two or three were being operated.

A. As the average result, yes; exactly.

Q. If a plant of three furnaces were constructed and one furnace

was being operated, and if the plant were properly and skilfully constructed, ought not that furnace be operated with one-third the boiler and engine power designed for the three furnaces?

A. Yes; it should be.

Q. You say that when you saw this furnace in operation at Sheffield that you were not there for any special purpose, only as a casual observer, and therefore did not take any special note of what was going on?

A. Of nothing except what seemed abnormal and attracted my attention. I was not there for the purpose of making any special observation.

Q. Did you observe as to the quantity of coal that was being used under boilers?

A. I did not. I remember that they were using coal.

Q. Did you make any examination of these boilers?

A. No.

Q. Do you know the size of these furnaces?

A. I do not. I was told that they were 75 feet high.

Q. In your opinion as an expert, assuming that the statements made about one of these furnaces requiring so much coal to be used under the boilers and requiring so many boilers and so many engines to be used to operate one furnace, and if the management is skillful, then what is your opinion as to the plant itself?

A. I have not heard any statement made as to what it required to operate them.

Q. Assuming, then, that it requires 500 lbs. of coal under the boilers for each ton of iron made, the furnace being 18 x 75 feet, and requires from two and one-half to three batteries of boilers out of six batteries to operate one furnace and requires three engines out of seven, then what is your opinion as to the construction of the plant itself?

445 A. Assuming that the ores and flukes filled in the furnace are normal—that is, the average of raw materials—I should infer, in the light of the limited data, that the boilers and engines were both of too small capacity for the work required of them.

Q. Well, in the light of this information, would it be possible to operate the three furnaces at once?

A. I should think not.

Q. What would it cost to replace the whole of these Babcock & Wilcox boilers with tubular or two-flue boilers in order to give sufficient power to operate these three furnaces?

A. I would have to make an estimate of that; I could not answer it off-hand; it would cost about $1,500 per hundred horse power.

Q. How much horse power do you think it would be required to operate the three furnaces?

A. That is a difficult question to answer; it would require considerable estimating.

Cross-examination by Mr. GUNTER:

Q. What is, when the furnace is running all right, with the usual ores, the usual pressure of blast in this country?

A. I do not know.

Q. Your experience in blast furnaces is confined to an anthracite region?

A. Yes.

Q. You do not know the usual blast used in furnaces in Alabama?

A. No, sir.

Q. Might not bad management require twice the duty of an engine in pumping the volume of air than when working properly?

A. Bad management has a bad effect upon any industrial occupation.

Q. Bad management might double the duty of an engine and yet not get half as much air into the furnace as good management?

A. I do not see any way in which bad management—I should hardly think it possible to get as much as double the duty without very bad management.

Q. He might have more pressure than was necessary if things were in their normal condition?

446 A. Yes, if the condition of the furnace was normal.

Q. There is a given quantity of air which is consumed per ton of iron?

A. Yes.

Q. And think it is very easy to calculate just what is required?

A. Yes.

Q. And that rule is 18 or 20 lbs. of air to the ton of iron?

A. Probably about that. I do not remember.

Q. There is very little difference between the air and the coal, and it is a very easy calculation to calculate the quantity of air required and the number of revolutions of an engine of a given capacity it will take to furnish the air?

A. All that is a very easy matter.

Q. It is a very easy matter for anybody at all familiar with the subject to determine the heating capacity of boilers necessary to produce a given amount of steam?

A. Exactly.

Q. And it is very easy to calculate the quantity of steam required to produce a given service?

A. Yes; it is very easy to do it; but these things must be measured and stated as a matter of fact and not of opinion.

Q. There are mathematical rules for all such things?

A. Yes; it is a professional service and must be gone at systematically.

Q. In boilers there are always three guage cocks?

A. Yes.

Q. At what point should the water be carried? It is not at the middle cock.

A. Generally speaking, at the middle cock. In sectional boilers

my experience is they want the water at the lowest point to maintain the water in the boilers at the middle cock.

Q. Then, in your opinion, in sectional boilers it should be carried at the lower part of the middle cock?

A. It should be carried at that point at which experience demonstrates it is possible to give dry steam.

Q. You know why these 12-in. mains are put together with what is called the flange joint?

A. Yes, sir.

Q. If one of these flange joints should leak how long
447 should it take to repair it with all the proper appliances?

A. It might take three or four hours, according to the luck, as you might say.

Q. But usually half an hour?

A. Yes, if everything went right.

Q. If you had two sets of pumps for the three furnaces, with reservoir tanks so arranged that you could take out any one of the five pumps, or any set of two pumps and repair them and run the furnaces from the reservoirs for 24 hours or longer without the pumps at the river, or from the river independently without the pumps at the reservoir, would you not consider that a sufficient arrangement?

A. If that could be done completely; if you could repair a portion of the steam pipes while you are running the others; if all are entirely independent of other machines you could still be able to operate your pumps; I would want my pump facilities to be independent of everything and have at least a duplicate service and be independent of every machine about the place, no matter what I had to stop.

Q. Suppose it was so arranged that you could cut off any boiler and repair it without interfering with others, or cut off any engine without interfering with the others, or cut off any one of the five pumps and repair it, or cut off any one of the two sets of pumps without interfering with the others, would you consider that sufficient?

A. At every boiler and at every pump there is a throttle valve, and at the intervening space between the throttle valves at the boilers on one side and those at the engines and pumps on the other in a large plant there is necessarily an immense amount of piping, and in case of any accident to any part of that piping your throttle valves at your machines are of little avail; you want to shut off parts of this steam pipe in order to repair it and still maintain the work of your plant, and to do this you must have valves in your steam pipes, so that not only an engine can be shut off, but certain boilers and engines must be shut off by pairs, so that the others can be on duty.

Q. Do these flange valves ever get out of order if properly made?

A. No, sir.

448 Q. If there is a valve between the throttle valves and the main steam pipe and the main steam-pipe joints seldom get out of order, what is the use of valves in the main steam pipe?

A. As a matter of fact, wherever you have joints they are liable to get out of order, and pipes and valves — arranged to cut off one part of the steam pipe from the other part, so that part of the boilers and part of the engines can be operated from this part of the main steam pipe while the other engines and boilers are off duty for making repairs without stopping your work until you stop the leaky joints.

Q. The gas produced from the furnace depends upon the state of the furnace and the materials that are used?

A. Yes.

Q. In other words, upon the management and materials?

A. Yes; and upon the construction of the plan throughout.

Q. The more complete the combustion in the furnace the less gas there will be that could be used afterwards in the way of burning?

A. I do not believe that. I believe just the other way.

Q. If there was complete combustion, would not the result be carbonic acid instead of carbonic oxide?

A. Yes; but in natural blast-furnace work there is always a large amount of gas on the top which is practically in the condition of gas-making and which have not yet reached the point where reduction takes place, and the gas goes off before the ores get to the point where the reduction takes place. The more complete the operation of smelting going on inside the furnace and the easier the furnace is working the probability is that it will make more instead of less gas.

Q. If only a given quantity of coal or coke is required for a ton of iron and only a given quantity of air is required to make the most perfect combustion that is possible in a blast furnace, how is the quantity of carbonic oxide increased by a more perfect operation of the furnace?

A. It might not be carbonic oxide at all; it might be distilled gases.

Q. What is distilled gases?

A. It is a hydrocarbon gas.

449 Q. What per cent. of carbonic acid issues from a furnace generally?

A. I do not remember.

Q. Do you recollect the proportion of carbonic oxide?

A. No, sir.

Q. In blast furnaces you only realize about forty per cent. of the heating capacity of the coal or coke you put in anyhow, don't you?

A. I do not remember just what per cent. These are questions with which I make no pretense to be familiar.

Q. In operating an engine, if there happened to be a little water in the cylinder as the piston was coming down or going up at a rate, it produces a great shock to the engine—what is called a toggle joint?

A. Yes, sir.

Q. The greater the amount of water in the cylinder the greater the force of the toggle joint?

A. Yes, sir.

Q. And it is almost resistless, is it not?

A. It is a very great force, but I do not know about its being resistless.

Q. It is very apt to result in stopping the engine or the breakage of something in the absence of a valve to let it out?

A. Yes, sir.

Q. If there were too much lead when the engine was running rapidly, the effect of that would make a cushion upon which it would strike?

A. Yes, sir.

Q. And that would make a lifting motion?

A. Yes; or a percussive motion, depending upon the rapidity at which the engine was going and the pressure of steam that was in the engine; that should not do any harm, though; water will do great damage, but steam ought not to do any harm.

Q. Is not the only difference between them that the steam is compressible and the water is not?

A. There can be no steam to make a cushion unless the valve is open; then the piston would force the steam through that same opening, out of its way; thereby the lead can do no harm.

Q. In a regular running engine, if there is no lead and no
450 cushion, the strains upon the engine are what is called self-contained, are they not; they balance each other except by a small difference?

A. There is a large momentum connected with engines that is not balance- by that pressure; when you first start the steam behind the piston the atmosphere is not compressed; the quick movement of the piston preceding the time that the atmosphere receive its compression is a quick stroke.

Q. If the moving parts of the engine—the main shaft, the fly-wheel, the cross-head, the piston weighed 65,000 lbs. and the pressure is less than 65,000 lbs., the moving parts never would be lifted up?

A. It might have a tendeney, but it would not be lifted up.

Q. If there was a cushion of water or steam for it to strike against, that would create a lifting force which would lift it up?

A. In case of water there would be, but in case of steam there would not, to an injurious extent.

By Mr. TOMPKINS:

Q. It is not a fact with two furnaces of the same size and capacity, with one using different materials from the other, will require a greater pressure of blast and harder work for the engines, and still the management of that plant be just as good as one that requires less steam?

A. Yes; it might be so.

Q. Speaking of sectional boilers, in regard to the test-cocks, if you carry the water too low, is not there, owing to the small amount of water in the boilers, a great danger of its sinking to keep the water at the proper level in the sectional than in the tubular boilers?

A. It is much more difficult to keep the water at the proper level in the sectional than in the tubular boilers.

Q. Speaking of leaks in those flange joints, supposing that the flange was so screwed upon the pipe that a leak should come in the pipe where screwed on, how long would it likely take to make the repairs?

A. It would depend upon the extent of the defect; it might have to be taken down and rethreaded, and in that case it would take from a half to two days.

451 Q. If, in the course of three or four weeks' running, $\frac{9}{10}$ of the joint should become leaky, what would be your inference?

A. It would look like bad joints.

Q. In regard to the lead on the engines, I understand you to say that the lead would make no material strain upon the engine that would be detrimental to good working of the engine?

A. No; provided the engine was built strong enough.

Q. Is there a possibility of building an engine and have its operation self-contained—that is, so that nothing about it will move from its foundation?

A. I never saw or heard of a large engine that did not require a large foundation and be well bolted to the foundations to hold it steady.

Q. Then, an engine of a weight of seventy tons with a bed plate ten or twelve feet long and six feet wide, with a bearing only at each end, say 1½ ft. at each end and none the balance of the way, running at 45 revolutions, and a pressure of ten pounds, and supposing there was no water or lead, would there be a tendency to break that bed plate?

A. There would be some strain which would have a tendency to break it.

Q. Where would that power come from?

A. From the steam cylinder, the air cylinder, and through the frame of the engine.

Q. Supposing you had a set of fly-wheels and main shaft weighing 35 tons, and they are so balanced heavier on one side than they are on the other, that tendency is to carry the wheel on the loaded side to the bottom, would not this have a tendency to make a jar or strain?

A. Any unbalanced wheel has a tendency to make a jar in its bearing.

D. A. TOMPKINS.

STATE OF GEORGIA, }
*Fulton County.* }

The foregoing testimony was duly taken and sworn to before me on 7th day of October, 1889.

GEO. S. LOWMAN,
*Commissioner.*

452 *Extract from Decree of Foreclosure and Sale.*

"At a stated term of the circuit court of the United States for the northern district and northern division of Alabama, held at Huntsville, Ala., on the third day of December, 1889.

Present: The Honorable Harry T. Toulmin, U. S. judge.

| | |
|---|---|
| CENTRAL TRUST COMPANY OF NEW YORK *vs.* SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY Co. and CHARLES D. WOODSON. | No. 150. In Equity. |

Decree of foreclosure and sale.

And now, on this day, the above-entitled cause came on to be further heard upon the original bill of complaint herein filed on the 9th day of January, 1889, and upon the answer of defendants, filed on 28th March, 1889, and replication of complainants, filed on 29th April, 1889, and the amended and supplementary bill of complaint, filed on 19th day of July, 1889, and the decree *pro confesso* upon said amended and supplementary bill, taken at the September rules, 1889, and upon the appearance of the several defendants, The Sheffield & Birmingham Coal, Iron & R'y Co. and Chas. D. Woodson, by their respective solicitors, who have consented to the entry of this decree as well as all orders and decrees heretofore entered in this cause; and thereupon and upon consideration thereof it is ordered, adjudged, and decreed as follows, namely:

* * * * * * *

And it is further ordered, adjudged, and decreed that said sale shall be made subject to any and all outstanding contractors', mechanics', vendors', or other liens covering or embracing said properties or premises or any part thereof which constitute liens upon said property prior to the lien of the mortgages foreclosed in this suit and which have not been ascertained and adjudicated by this court, and expressly subject to the receiver's certificates heretofore authorized to be issued by said Jacob G. Chamberlain, receiver, to an amount not exceeding $150,000, said receiver's certificates being a first and prior lien upon said properties as between them and the two mortgages aforesaid or either of them and the amount of said receiver's certificates issued and constituting such lien, being as set forth in Schedule "B," hereto annexed and made a part of this decree; and the purchaser or purchasers of said property shall take the same upon the express condition that he or they will pay off and satisfy any and all claims now pending and undetermined in this court accruing prior to the appointment of a receiver herein and during the receivership which may be allowed by this court as prior in right to said mortgages or either of them, together with such interest as may be allowed and all costs and expenses connected with such pending
453 and undetermined suits, properly chargeable thereto, and also upon the express condition that such purchaser or pur-

chasers will pay off, discharge, and satisfy all debts, claims, or demands of whatsoever nature which have been or may hereafter be incurred by said J. G. Chamberlain, receiver, and which have not been or may not hereafter be paid by said Jacob G. Chamberlain or any party in interest herein; and said purchaser or purchasers, their successor or successors or assigns, shall have the right to appear and make defence to any claim, debt, or demand sought to be enforced against said property now in suit or hereinafter to be sued on, and to use the name or names of any party to this suit in the prosecution or defence of such claims; and such purchaser or purchaser, their successors or assigns, shall also have the right to enter appearance in this or any other court and contest any claim or demand pending and undetermined at the date of confirmation of said sale. All claims, debts, or demands accrued during the receivership herein shall be barred unless presented, as provided, within six months after the confirmation of this sale, and jurisdiction of this cause is retained by this court for the purpose of enforcing the provisions of this article of this decree.

* * * * * * *

The court hereby expressly reserves for further considerations all the matters pertaining to said cause not herein adjudicated and determined.

Dec. 3, 1889.

(S'gn'd) HARRY T. TOULMIN,
*U. S. Judge.*"

BUTLER, STILLMAN & HUBBARD,
*Solicitors for Complainant.*
HENRY B. TOMPKINS, *Of Counsel.*

454 In Circuit Court of U. S., Northern District & Northern Division of Ala.

SHEFFIELD & BIRMINGHAM COAL, IRON & R'Y Co., Appellant,
*v.*
GORDON, STROBEL & LAUREAU, Appellees.

*Petition for Appeal and Supersedeas.*

Filed in clerk's office July 16th, A. D. 1890.

A. W. McCULLOUGH, *Clerk.*

Entered in Final Record "X," page "300."

(Copy.)

455 In the Circuit Court of the United States for the Northern District & Northern Division of Alabama. In Equity.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD & BIRMINGHAM COAL, IRON & R'Y Co. and Another.

*In Re* Intervention of GORDON, STROBEL & LAUREAU, LIMITED,
*vs.*
SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY Co.

To the honorable judges of the circuit court of the United States for the fifth judicial circuit, having jurisdiction in equity:

The petition of the Sheffield & Birmingham Coal, Iron & Railway Company respectfully shows—

That on the 9th of January, 1889, the Central Trust Co. of New York filed its bill in this honorable court against the Sheffield & Birmingham Coal, Iron & R'y Co. and another for the foreclosure of a mortgage or deed of trust upon certain three furnaces and sixty acres of ground upon which they are situated on the Tennessee river, in Colbert county, Ala., and the appurtenances therewith connected, and also about seventy thousand acres of mineral lands and mineral rights lying in certain counties in the State of Alabama and other properties as therein set forth and described; that on the 12th day of January, 1889, Jacob G. Chamberlain was appointed receiver of said furnaces and property and took possession of the same under said order; that on the 11th day of February, 1889, an intervention was filed in the above-stated equity cause by Gordon, Strobel & Laureau, Limited, who averred themselves to be partners under that firm
456 name and who were citizens of and residing in the State of Pennsylvania, composed of Frederick W. Gordon, Victor O. Strobel, Lewis G. Laureau, and Thomas G. Boyle; that by said intervention of said Gordon, Strobel & Laureau, Limited, they claimed a mechanics' and contractors' lien upon said three iron furnaces at Sheffield, Ala., and one acre of ground upon which they are situated under and by virtue of the statutes of the State of Alabama, which lien amounted to, as claimed by them, the sum of sixty thousand three hundred and twelve dollars and sixty-six cents, for balance due them on account of the construction of said three iron furnaces under a contract to construct same for the sum of five hundred and sixty-four thousand dollars; that on the 23d day of April, 1889, the Central Trust Co. of New York and Sheffield & Birmingham Coal, Iron & R'y Co., together with said J. G. Chamberlain, receiver, filed an answer in the nature of a cross-bill to the intervention of said Gordon, Strobel & Laureau, Limited; that said intervention of said parties seeking to establish said mechanics' lien was duly referred to David D. Shelby, special master in chancery, to inquire into the same and state to the court whether the matters and things there alleged were true, and also to inquire into and state to the court whether or not the matters and things set forth in the answer to

said petition were true, and for other purpose set forth in said reference to said special master; that afterwards a large amount of testimony was taken before said master by said intervenors and by the respondents to said intervention, and that on the 25th of February, 1890, said D. D. Shelby, special master, made his report to the court, finding, among other things, that the Sheffield & Birmingham Coal, Iron & Railway Co. were indebted to Gordon, Strobel & Laureau, Limited, the sum of fifty-seven thousand eight hundred and eight dollars and twelve cents, with interest at eight per cent. per annum from 18th September, 1888; that afterwards, on the 17th day of March, 1890, exceptions were filed to said report of said special master in chancery by the Central Trust Co. of New York, the Sheffield & Birmingham Coal, Iron & R'y Co., and by J. G. Chamberlain, re-
457 ceiver, and that afterwards a hearing upon said exceptions to said report came on before Hon. Don A. Pardee on the 12th day of June, 1890, at which time the Sheffield & Birmingham Coal, Iron & R'y Co. and the Central Trust Co. of New York filed an amendment to their answer in the nature of a cross-bill to the intervention of Gordon, Strobel & Laureau, which amendment being submitted to the court it was ordered that the same be not allowed to be filed; to which ruling the solicitors then and there excepted. In said amendment it was set up and alleged that said Gordon, Strobel & Laureau were not a firm or partnership, as by them alleged and set forth in their original intervention, but that they were a corporation duly organized under the laws of the State of Pennsylvania, and, not having complied with the laws of the State of Alabama entitling them to do business in said State of Alabama, said Gordon, Strobel & Laureau had no authority to bring their intervention for the establishment of a mechanics' or contractors' lien against said properties situated at Sheffield, and this honorable court had no authority to make any finding in their favor; that said respondents to the intervention of Gordon, Strobel & Laureau also filed a further amendment to their answer and cross-bill to the original intervention of Gordon, Strobel & Laureau, alleging that it was necessary, in order to operate one of said furnaces so constructed by said Gordon, Strobel & Laureau, to consume from 350 to 500 lbs. of coal to each ton of iron, and that each ton of iron so made cost from forty to fifty cents per ton more than it should have cost, neither of which said amendments would said court consider upon said hearing; that the Central Trust Co. of New York and the Sheffield & Birmingham Coal, Iron & R'y Co. at such hearing upon the exceptions to the master's report on 12th June, 1889, offered to introduce an affidavit made by Enoch Ensley in reference to the inefficiency of said furnaces, which affidavit the court allowed filed, but ordered suppressed and would not consider upon hearing; that after argument by counsel representing both sides at the hearing of said exceptions to said master's report said court took the case under advisement, and on the
458 24th of June, 1890, rendered a decree that "the exceptions to the master's report be, and the same are hereby, overruled, and said reports be, and the same is hereby confirmed," and said court further ordered and decreed that "said intervenors,

Gordon, Strobel & Laureau, do have and recover of the defendant, The Sheffield & Birmingham Coal, Iron & R'y Co., as recommended in said master's report, the sum of $57,808.12, with interest thereon at six per cent. from 18th December, 1888, until paid, and all costs of this intervention, to be taxed, and that a mechanics' lien, as given by the laws of the State of Alabama and claimed and set forth in the intervention on file, be, and the same is hereby, fully recognized and allowed as being a subsisting first lien upon the property specifically described in said intervention and exhibits." The court further ordered and decreed that said amount, with interest as aforesaid and all costs as aforesaid, be paid by said Sheffield & Birmingham Coal, Iron & R'y Co. or the parties purchasing the property at the sale under the foreclosure of the mortgage, to be made within twenty days from the time of the filing of said decree of said court, to wit, the 26th day of June, 1890, and that in default thereof and order for the resale of said property may issue.

Petitioner further sets forth and shows that on the 3d day of December, 1889, a decree of foreclosure and sale was rendered at a regular term of the honorable circuit court of the United States at Huntsville, Ala., in said cause of The Central Trust Company of New York against Sheffield & Birmingham Coal, Iron & R'y Co. and another, whereby said three furnaces, including the ground upon which they were situated, at Sheffield, Ala., were ordered to be sold by said D. D. Shelby, special master in chancery, under certain terms and conditions therein set forth and decreed, and that in said final decree it was expressly stipulated and provided that the purchaser or purchasers, their successor, successors, or assigns, who should purchase said property under said decree of foreclosure and sale shall have the right to appear and make defense to any claim,
459 debt, or demand sought to be enforced against said property now in suit or hereinafter to be sued on and use the name or names of any parties to this suit in the prosecution or defense of such claims, and such purchaser or purchasers, their successors or assigns, shall also have the right to enter appearance in this or any other court and contest any claim or demand pending and undetermined at the time of the confirmation of said sale.

And *in* said decree of foreclosure and sale shall be made subject to any and all outstanding contractors', mechanics', vendors', or other liens covering and embracing said properties and premises or any part thereof which constitute liens upon said property prior to the lien of the mortgages foreclosed in this suit and which have not been ascertained and adjudicated by this court.

And petitioner avers that at the time of the sale of said properties by said special master in chancery, on the 21st of April, 1890, said claim of said Gordon, Strobel & Laureau had not been finally adjudicated and decreed upon; that at said sale of said property, upon which said Gordon, Strobel & Lareau claimed a mechanics' lien prior to the mortgage under foreclosure of which the same was sold on 21st April, 1890, it was bid in and purchased by and afterwards deeded to Napoleon Hill, as trustee for certain bondholders, and that after-

wards, to wit, on the 1st of July, 1890, a company was formed under the laws of the State of Alabama with its principal place of business at Sheffield, in said State of Alabama, known as the Alabama Iron & Railway Co., and to which company said Napoleon Hill, trustee, has conveyed, among other property, said three furnaces and the site upon which they are situated, and that said furnaces and one acre of ground, upon which said Gordon, Strobel & Laureau claim to have a lien, are now owned and controlled by said Alabama Iron & Railway Co., as successor to and assignee of said Sheffield & Birmingham Coal, Iron & Railway Co., whose name is used in this proceeding under and by virtue of the authority above stated and set forth in said decree of foreclosure and sale of 3d December, 1889.

460 Wherefore the above-named petitioner, Sheffield & Birmingham Coal, Iron & R'y Co., conceiving itself aggrieved by said order of said circuit judge, Hon. Don A. Pardee, made on 24th of June, 1890, and entered on 26th June, 1890, in the above-entitled and referred proceedings, doth hereby appeal from said order to the Supreme Court of the United States, and prays that this its appeal may be allowed, and that a transcript of the record and the papers upon which this order was made, duly authenticated, may be sent to the Supreme Court of the United States by the clerk of the United States circuit court for the northern district and northern division of Alabama, and that upon a bond being given as required that a supersedeas be granted staying said judgment and decree of said Gordon, Strobel & Laureau against said three iron blast furnaces and one acre of ground upon which they are situated until the Supreme Court of the United States has heard this appeal.

SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY COMPANY,
By HENRY B. TOMPKINS, *Solicitor.*

461 In Circuit Court of U. S., Northern Dist. & Northern Div. of Alabama.

SHEFFIELD & BIRMINGHAM COAL, IRON & R'Y CO., Appellant,
*v.*
GORDON, STROBEL & LAUREAU, Appellees.

*Order Allowing Appeal and Supersedeas.*

Filed in clerk's office July 16, 1890.

A. W. McCULLOUGH, *Clerk.*

Entered in Final Record "X," page "306."

Gordon, Strobel & Laureau, do have and recover of the defendant, The Sheffield & Birmingham Coal, Iron & R'y Co., as recommended in said master's report, the sum of $57,808.12, with interest thereon at six per cent. from 18th December, 1888, until paid, and all costs of this intervention, to be taxed, and that a mechanics' lien, as given by the laws of the State of Alabama and claimed and set forth in the intervention on file, be, and the same is hereby, fully recognized and allowed as being a subsisting first lien upon the property specifically described in said intervention and exhibits." The court further ordered and decreed that said amount, with interest as aforesaid and all costs as aforesaid, be paid by said Sheffield & Birmingham Coal, Iron & R'y Co. or the parties purchasing the property at the sale under the foreclosure of the mortgage, to be made within twenty days from the time of the filing of said decree of said court, to wit, the 26th day of June, 1890, and that in default thereof and order for the resale of said property may issue.

Petitioner further sets forth and shows that on the 3d day of December, 1889, a decree of foreclosure and sale was rendered at a regular term of the honorable circuit court of the United States at Huntsville, Ala., in said cause of The Central Trust Company of New York against Sheffield & Birmingham Coal, Iron & R'y Co. and another, whereby said three furnaces, including the ground upon which they were situated, at Sheffield, Ala., were ordered to be sold by said D. D. Shelby, special master in chancery, under certain terms and conditions therein set forth and decreed, and that in said final decree it was expressly stipulated and provided that the purchaser or purchasers, their successor, successors, or assigns, who should purchase said property under said decree of foreclosure and sale shall have the right to appear and make defense to any claim,
459 debt, or demand sought to be enforced against said property now in suit or hereinafter to be sued on and use the name or names of any parties to this suit in the prosecution or defense of such claims, and such purchaser or purchasers, their successors or assigns, shall also have the right to enter appearance in this or any other court and contest any claim or demand pending and undetermined at the time of the confirmation of said sale.

And *in* said decree of foreclosure and sale shall be made subject to any and all outstanding contractors', mechanics', vendors', or other liens covering and embracing said properties and premises or any part thereof which constitute liens upon said property prior to the lien of the mortgages foreclosed in this suit and which have not been ascertained and adjudicated by this court.

And petitioner avers that at the time of the sale of said properties by said special master in chancery, on the 21st of April, 1890, said claim of said Gordon, Strobel & Laureau had not been finally adjudicated and decreed upon; that at said sale of said property, upon which said Gordon, Strobel & Lareau claimed a mechanics' lien prior to the mortgage under foreclosure of which the same was sold on 21st April, 1890, it was bid in and purchased by and afterwards deeded to Napoleon Hill, as trustee for certain bondholders, and that after-

wards, to wit, on the 1st of July, 1890, a company was formed under the laws of the State of Alabama with its principal place of business at Sheffield, in said State of Alabama, known as the Alabama Iron & Railway Co., and to which company said Napoleon Hill, trustee, has conveyed, among other property, said three furnaces and the site upon which they are situated, and that said furnaces and one acre of ground, upon which said Gordon, Strobel & Laureau claim to have a lien, are now owned and controlled by said Alabama Iron & Railway Co., as successor to and assignee of said Sheffield & Birmingham Coal, Iron & Railway Co., whose name is used in this proceeding under and by virtue of the authority above stated and set forth in said decree of foreclosure and sale of 3d December, 1889.

460 Wherefore the above-named petitioner, Sheffield & Birmingham Coal, Iron & R'y Co., conceiving itself aggrieved by said order of said circuit judge, Hon. Don A. Pardee, made on 24th of June, 1890, and entered on 26th June, 1890, in the above-entitled and referred proceedings, doth hereby appeal from said order to the Supreme Court of the United States, and prays that this its appeal may be allowed, and that a transcript of the record and the papers upon which this order was made, duly authenticated, may be sent to the Supreme Court of the United States by the clerk of the United States circuit court for the northern district and northern division of Alabama, and that upon a bond being given as required that a supersedeas be granted staying said judgment and decree of said Gordon, Strobel & Laureau against said three iron blast furnaces and one acre of ground upon which they are situated until the Supreme Court of the United States has heard this appeal.

SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY COMPANY,
By HENRY B. TOMPKINS, *Solicitor.*

461 In Circuit Court of U. S., Northern Dist. & Northern Div. of Alabama.

SHEFFIELD & BIRMINGHAM COAL, IRON & R'Y CO., Appellant,
*v.*
GORDON, STROBEL & LAUREAU, Appellees.

*Order Allowing Appeal and Supersedeas.*

Filed in clerk's office July 16, 1890.

A. W. McCULLOUGH, *Clerk.*

Entered in Final Record "X," page "306."

(Copy.)

462 In the Circuit Court of the United States for the Northern District & Northern Division of Ala. In Equity.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY CO. and Another.

*In re* intervention of Gordon, Strobel & Laureau, Limited.

Petition of the Central Trust Company of New York and the Sheffield & Birmingham Coal, Iron & R'y Co. for appeal by the Sheffield & Birmingham Coal, Iron & Railway Company on judgment and decree of Gordon, Strobel & Laureau.

*Order Allowing Appeal and Supersedeas.*

In this cause the defendant The Sheffield & Birmingham Coal, Iron & Railway Company having made its application in writing for an appeal from the final decree in favor of Gordon, Strobel & Laureau to the Supreme Court of the United States, accompanying said application with bond for the appeal in the sum of fifty thousand eight hundred & eight $\frac{12}{100}$ dollars, which said sum is hereby fixed as the amount of the penalty of the bond for supersedeas of the decree, and it appearing to my satisfaction that the matter in dispute in said cause, wherein Gordon, Strobel & Laureau are intervenors in the case of the Central Trust Co. of New York against Sheffield & Birmingham Coal, Iron & Railway Co. and another, exceeds the sum or value of five thousand dollars, exclusive of costs, and said bond and security therein is good and sufficient and this day approved by me—

It is therefore ordered, adjudged, and decreed that said application for said appeal be, and the same is hereby, granted, and that the clerk of said court is hereby ordered to stay all proceedings in execution of said final decree until the final determination of said appeal and until further orders therein.

463 This the 15th day of July, 1890.

L. Q. C. LAMAR,
*Associate Justice of the Supreme Court of the United States.*

464 SHEFFIELD & BIRMINGHAM C., I. & R'Y CO.
*v.*
GORDON, STROBEL & LAUREAU, LIMITED.

*Supersedeas Bond.*

Filed in clerk's office July 16, 1890.
A. W. McCULLOUGH, *Clerk.*

Entered in Final Record "X," page "307."

(Copy.)

465 In the Circuit Court of the United States for the Northern District & Northern Division of Ala. In Equity.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY CO. and Another.

*In re* intervention of Gordon, Strobel & Laureau, Limited.

*Supersedeas Bond.*

Know all men by these presents that we, The Sheffield & Birmingham Coal, Iron & R'y Co., principal, and E. W. Cole, of Nashville, Tenn., and Napoleon Hill and J. C. Neely, of Memphis, Tenn., sureties, are held and firmly bound unto the above-named Gordon, Strobel & Laureau, Limited, in the sum of fifty-seven thousand eight hundred and eight $\frac{12}{100}$ dollars, to be paid to the said Gordon, Strobel & Laureau, their assigns or successors, and for the payment of which, well and truly to be made, we bind ourselves and each of us, our and each of our heirs, executors, and administrators, jointly and severally, firmly by these present-.

Sealed with our seals and dated this the 15th day of July, 1890.

Whereas the above-named Sheffield & Birmingham Coal, Iron & Railway Co. has prosecuted an appeal to the Supreme Court of the United States to reverse the decree rendered in the above-entitled suit and intervention by the judge of the circuit court of the United States for the northern district & division of Alabama:

466 Now, therefore, the condition of this obligation is such that if the above-named Sheffield & Birmingham Coal, Iron & Railway Co. shall prosecute said appeal to effect and answer all damages and costs if it fail to make said appeal good, then this obligation shall be void; otherwise the same shall be and remain of full force and virtue.

SHEFFIELD & BIRMINGHAM COAL, IRON & R'Y CO.
E. W. COLE, *Pres't.* [SEAL.]
E. W. COLE, *Security.* [SEAL.]
NAPOLEON HILL, [SEAL.]
J. C. NEELY, *Security.* [SEAL.]

Witnesses as to Napoleon Hill & J. C. Neely:
J. M. TREZEVANT,
*Notary Public, Shelby County, Tenn.*

STATE OF TENNESSEE, }
*Davidson County.* }

Personally appeared before me, G. W. Davis, notary public in and for said county, the within-named E. W. Cole, the bargainor,

with whom I am personally acquainted, and acknowledged that he executed the annexed instrument for the purposes therein expressed.

466½ Witness my hand and official seal this 5th day of July, 1890.

[SEAL.] G. W. DAVIS,
*Notary Public.*

STATE OF TENNESSEE, }
*Shelby County.* }

Personally appeared before me, J. M. Trezevant, a notary public within and for said State and county, Napoleon Hill and J. C. Neely, the within-named bargainers, with whom I am personally acquainted, and who acknowledged that they executed the within instrument for the purposes therein contained.

Witness my hand and seal notarial this seventh day of July, A. D. 1890.

[SEAL.] J. M. TREZEVANT,
*Notary Public.*

Approved by—

L. Q. C. LAMAR,
*Circuit Judge.*

467 In Circuit Court of United States, Northern Dist. & No. Div. of Alabama.

SHEFFIELD & BIRMINGHAM COAL, IRON & R'Y CO., Appellant, }
*v.*
GORDON, STROBEL & LAUREAU, Appellees. }

*Citation on Appeal.*

Original.

Filed in clerk's office July 16th, 1890.

A. W. McCULLOUGH, *Clerk.*

(Copy.)

Entered in Final Record "X," page "309."

468 In the Circuit Court of the United States for the Northern District & Northern Division of Ala. In Equity.

CENTRAL TRUST COMPANY OF NEW YORK
*vs.*
SHEFFIELD & BIRMINGHAM COAL, IRON & R'Y CO. and Another.

*In re* intervention of Gordon, Strobel & Laureau, Limited.

Petition of the Central Trust Company of New York and the Sheffield & Birmingham Coal, Iron & R'y Co. for appeal by the Sheffield & Birmingham Coal, Iron & Railway Company on judgment and decree of Gordon, Strobel & Laureau.

*Citation on Appeal.*

To Gordon, Strobel & Laureau, Limited, composed of Frederick W. Gordon, Victor O. Strobel, Lewis G. Laureau, and Thomas G. Boyle, Greeting:

You are hereby cited and admonished to be and appear at a Supreme Court of the United States, to — holden at Washington, D. C., on the second Monday in October, 1890, pursuant to an appeal filed in the clerk's office of the circuit court of the United States for the northern district and division of Alabama, wherein The Sheffield & Birmingham Coal, Iron & Railway Co. is appellant and Gordon, Strobel & Laureau, Limited, are appellees, to show cause, if any there be, why the judgment and decree in said petition for appeal mentioned should not be corrected and speedy justice should not be done to the parties in that behalf.

Witness the Honorable Melville W. Fuller, Chief Justice of the United States, this 15th day of July, 1890.

L. Q. C. LAMAR,
*Associate Justice Supreme Court of the United States.*

Received in U. S. marshal's office July 19th, 1890.
A. R. NININGER,
*U. S. Marshal.*

Executed by serving copy of the within citation on Robert C. Brickell, solicitor for appellees, this 21st day of July, 1890.
A. R. NININGER,
*U. S. Marshal.*

469 UNITED STATES OF AMERICA,
*Northern District of Alabama, Northern Division.*

I, A. W. McCullough, clerk of the circuit court of the United States of America in and for said division of said district, do hereby certify that the following is a true, full, and complete copy of the papers filed and the proceedings thereon had in an intervention lately pending in said court, wherein Gordon, Strobel and Lareau, Limited, intervene in the cause of Central Trust Company of New

York against the Sheffield and Birmingham Coal, Iron and Railway Company and another, as fully as the same does appear of record in my office.

Seal U. S. Circuit Court, N. D. of Alabama.

In testimony whereof I have hereunto subscribed my name and affixed the seal of said court, at office, in the city of Huntsville, in said district, this 29th day of August, A. D. 1890.

A. W. McCULLOUGH,
*Clerk of the U. S. Circuit Court.*

Endorsed on cover: Case No. 14,142. N. Alabama C. C. U. S. No. 424. The Sheffield & Birmingham Coal, Iron & Railway Company, appellant, *vs.* Gordon, Strobel and Laureau (Limited), composed of Frederick W. Gordon, Victor O. Strobel, Lewis S. Laureau, and Thomas G. Boyle. Filed September 11, 1890.

Office Supreme Court U. S.
FILED.
APR 29 1893
JAMES H. McKENNEY,
CLERK.

# In Supreme Court of United States.

## TERM No. 424.

THE SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY, COMPANY,
Appellant.

*vs.*

GORDON, STROBEL & LAUREAU (Limited),
Composed of Frederick W. Gordon, Victor O. Strobel and Lewis S. Laureau, and Thomas G. Boyle.

# In Supreme Court of United States.

## TERM No. 424.

THE SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY, COMPANY,
Appellant.

*vs.*

GORDON, STROBEL & LAUREAU (Limited),
Composed of Frederick W. Gordon, Victor O. Strobel and Lewis S. Laureau, and Thomas G. Boyle.

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MOTION.

The appellees in this case move the court to dismiss the appeal, on the ground that it is taken in the name of only one of the respondents in the court below. And this failing, to affirm the decree of the lower court, on the ground that it is manifest that the appeal was taken for delay only.

W. A. GUNTER,
Solicitor for Appellees.

## STATEMENT OF THE CASE.

The appellees filed an intervening petition in a cause pending in the circuit court for the northern district of Alabama for the foreclosure of a deed of trust, setting up and claiming a mechanic's lien on certain furnace property described in the petition, to secure the payment of a large balance due them as builders. Record, 1 to 12.

The defendants to this petition, all of whom appeared and answered, were the Central Trust Company of New York, who was the trustee under a deed of trust embracing the property mentioned in the intervening petition, the Sheffield, Birmingham Coal, Iron and Railway Company, who was the mortgagor, Jacob G. Chamberlain, who was receiver in said cause, and one, Charles D. Woodson—Record 6 and 15.

By consent of all parties a decree was rendered referring it to a special master to report upon the intervening claim. Record 15-14.

The master reported that intervenors were to erect certain works for a given price according to specifications, that the superintendent of appellant was to pass upon the work every two weeks, and if to his satisfaction it was to be a final acceptance so far as done ; that the agreed price was $564,-000. And that the evidence showed, without conflict, that appellant's superintendent did supervise and inspect the work and passed it from time to time, making changes as he thought proper. And that when the work was finished, the contractors asked a final acceptance, and that this was given by the same superintendent on the direction of the president of appellant. The master further reported that the evidence did not sustain the defenses of the respondents, and that the contractors were entitled to be paid the contract price of their work. A balance of $57,808.12 was reported due, with interest at eight per cent from 18th September, 1888, and that the intervenors were entitled to a mechanic's lien on the premises according to the law of Alabama. Record 24-5-6.

Exceptions to this report were overruled, and a final decree rendered approving the master's report in all respects, and ordering a sale of the property for the satisfaction of the decree unless payment was made.

Record, 28–9.

From this decree the present appeal was taken by one of the respondents only, the record showing no reason for the non-joinder of the others.

Record, 320, 324–5.

## Argument.

The law seems to be settled that appeals must be taken in the name of all the respondents, unless there is a summons and severance or an equivalent proceeding.

Hardee v. Wilson, 146 U. S. 179.

Masterson v. Herndon, 10 Wall. 416.

Downing v. McCartney, Appendix to 131 U. S. 98.

Mason v. U. S. 136 U. S. 581.

Feibelman v. Packard, 108 U. S. 14.

The only possible answer which can be offered against the dismissal in this case is that the decree appealed from is against the present appellant only.

Record, 28–9.

But this contention can not be sustained. The title to the property was in the Central Trust Company of New York, the trustee under the deed of trust for the bondholders, and these bondholders were the real *cestui que trusts* of the property condemned to the satisfaction of the debt.

Jones on Corp. Securities, § 294.

The decree could not have given a "recovery" or personal judgment against any one except the mortgagor, but it could, and did condemn and subordinate the right of all the respondents to the claim of the intervenors, and was thus a decree which all of them, and particularly the trustee under the deed of trust, could have defended against on appeal, as was done in the lower court.

Hardee v. Wilson, 146 U. S. 179.

The trustee representing the legal title of the property condemned, and also representing the bondholders who were entitled to the proceeds of the property, had a greater interest than the mortgagor, and being a party in the lower court, and the decree being an unqualified condemnation of the property, there can be no doubt that the decree was against it, and that it could and should have joined in the appeal.

It is insisted, in the event the motion to dismiss is overruled, that an inspection of the record will show that the appeal was taken only for delay.

In determining this question it must be assumed that the appellant knows the law, and that illusory hopes, however honest, of overruling settled principles and the effect of undisputed evidence, can not relieve any one from the imputation of a purpose to delay in appeals in plain cases.

The purpose of this appeal relates only to the overruling of the exceptions to the master's report.

Record, 26–7–8–9.

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Record, 26–7–8–9.

Office Supreme Court U. S.
FILED.
APR 28 1893.
JAMES H. McKENNEY,
CLERK.

RECORD CASE No. 14,142.

# SUPREME COURT OF THE UNITED STATES

October Term, 1892. Term No. 424.

THE SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY,
Appellant.

vs.

GORDON, STROBEL & LAUREAU (LIMITED), COMPOSED OF FREDERICK W. GORDON, VICTOR O. STROBEL, LEWIS S. LAUREAU AND THOMAS G. BOYLE.

Appeal from the Circuit Court of the United States for the Northern District of Alabama.

*STATEMENT AND BRIEF FOR APPELLANT,*

*In reply to Motion of Appellees to dismiss the bill or to affirm the decree of the Court below.*

*Filed*_____*1893.*

S. W. Postell, Law Printer, Atlanta, Ga.

Office Supreme Court U. S.
FILED.
APR 28 1893.
JAMES H. McKENNEY,
CLERK.

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RECORD CASE No. 14,142.

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Appeal from the Circuit Court of the United States for the Northern District of Alabama.

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## *STATEMENT AND BRIEF FOR APPELLANT,*

*In reply to Motion of Appellees to dismiss the bill or to affirm the decree of the Court below.*

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## STATEMENT.

1. The statement of the case as made by solicitors for appellees is so defective that it is necessary to revise it.

On the 9th January, 1889, the Central Trust Company of New York filed its bill against the Sheffield and Birmingham

Coal, Iron and Railway Company and Charles D. Woodson, citizens of the northern district of Alabama, said bill being filed in the Circuit Court of the United States for the Northern District of Alabama, at Huntsville, and being for the foreclosure of a mortgage upon certain properties, including the three furnaces at Sheffield upon which the appellees claimed to have a lien. J. G. Chamberlain was appointed receiver, and the case proceeded to final decree on the 3d day of December, 1889, and the property was sold under said decree on the 21st day of April, 1890, and purchased by Napoleon Hill, as trustee for the bondholders; and thereafter, on the 1st day of July, 1890, a new corporation having been formed under the laws of the State of Alabama, known as the Alabama Iron and Railway Company, to which Napoleon Hill, trustee, conveyed the three iron furnaces and the ground upon which they were situated and upon which the appellees claimed a lien. So that on the 21st April, 1890, whatever title the Central Trust Company of New York, as trustee, may have had in the property was absolutely divested.

On the 11th February, 1889, after the institution of the foreclosure suit on the 9th January, of that year, the appellees filed an intervention in said suit, claiming a contractor's lien upon the furnaces and one acre of the site at Sheffield; and after having been referred to the Special Master, and after his finding in favor of the intervenors, the appellees in this court, and after exceptions to the Master's report, the Honorable Don A. Pardee, Circuit Judge, overruled the exceptions and confirmed the finding of the Master, by order made on the 24th June, and entered on the 26th June, 1890.

For these facts see Transcript of Record, pages 24 to 29 inclusive, and pages 320 to 323 inclusive.

The hearing of the exceptions to the Master's report was by ~~agreement~~ *agreement* of counsel and any irregularities were thereby waived. Transcript of Record, pp. 23 and 28.

2. Prompt application for an appeal was taken from this decree of the circuit judge by the appellant, and on the 15th day of July, 1890, the late Mr. Associate Justice L. Q. C. Lamar granted an order allowing an appeal and supersedeas. See Transcript of the Record, page 324.

At that date all the right, title and interest in and to said property upon which said appellees claimed a lien was vested in the new corporation known as the Alabama Iron and Railway Company. The receiver, J. G. Chamberlain, had been discharged, and there never had been any decree of any kind against said Charles D. Woodson, whom the bill shows had been joined simply as a nominal party, and the only relief granted by the decree of foreclosure and sale was against the Sheffield and Birmingham Coal, Iron and Railway Company and its property.

3. The appeal was prosecuted in the name of the Sheffield and Birmingham Coal, Iron and Railway Company, which was at the time of filing of the intervention of the appellees the owner of the funaces and the furnace site, subject to the mortgage then being foreclosed. The name of the Sheffield and Birmingham Coal, Iron and Railway Company was used instead of that of the Alabama Iron and Railway Company, which at the date of the granting of the appeal on 15 July, 1890, was the real owner of the property, to avoid complicating the case by bringing the name of another party into the litigation; and because under the decree of foreclosure and sale granted on the 3d day of December, 1889, the court had given special authority to the purchasers of said property under the sale to be made under said decree of 3d December, 1889, as follows: "And said purchaser or purchasers, their successor or successors or assigns, shall have the right to appear and make defence to any claim, debt or demand sought to be enforced against said property now in suit or hereafter to be sued on, *and to use the name or names of any party to*

*this suit in the prosecution or defence of said claims.*" See Transcript of Record, page 319. It was this provision of the decree that the Alabama Iron and Railway Company availed itself of in using the name of its predecessor the Sheffield and Birmingham Coal, Iron and Railway Company.

## LAW POINTS.

1. It is not settled "that appeals must be taken in the name of all the respondents, unless there is a summons and severance or equivalent proceedings," as contended for by counsel for appellees, on page 2 of his brief. On the contrary, the rule is that appeals or writs of error must be taken in the name of all the respondents unless there is a summons and severance, or equivalent proceedings, *where there has been a decree in equity or judgment at law which is joint against all the defendants.*

In the case now under consideration neither the finding of the Master of Chancery nor the decree of the Circuit Court was against any defendant or respondent in the intervention instituted by the appellees except against the Sheffield and Birmingham Coal, Iron and Railway Company. The finding of the Master was not against the Central Trust Company of New York, Charles D. Woodson or Jacob G. Chamberlain, receiver. See Transcript of Record, pages 24 to 26. It is here shown that a lien was given on the property described and the account was shown to be against the Sheffield and Birmingham Coal, Iron and Railway Company and its successors, and against none other. So in the decree of the court on pages 28 to 29 these words are used: "It is further ordered, adjudged and decreed that the intervenors, Gordon, Strobel & Laureau, do have and recover of the defendant, Sheffield and Birmingham Coal, Iron and Railway Company, as recommended in said Master's report," etc. No joint judg-

ment was recommend by the Master or given by the court, but the decree was alone against the appellant in this case.

2. On page 3 of appellee's brief it is said that "title to the property was in the Central Trust Company of New York, etc." It has already been shown, by reference to the transcript of the record, that the title to the property against which the contractor's lien is sought by appellees was not in the Central Trust Company of New York, either at the time of the appeal on the 15th July, 1890, or at the date of the rendition of the decree by Judge Pardee on the 12th June, 1890, as on the 21st April, 1890, the sale had taken place under the final decree of foreclosure and the property purchased by Napoleon Hill, trustee for the bondholders.

3. A careful examination of all the authorities cited by counsel for appellees, as well as all the other authorities bearing upon the same point as to the necessity of having "a summons and severance," discloses that in every single case the decree or judgment was a joint one against two or more defendants and not against one of the defendants or respondents, as in this case. Further, there was no personal judgment or decree against anyone in this case except Sheffield and Birmingham Coal, Iron and Railway Company, with the stipulation that such judgment or decree should be a subsisting first lien upon the property specifically described in said intervention and exhibits. Further, the decree, after recognizing that the property had been sold and delivered under the decree of foreclosure and sale at that date, to-wit, 24th June, 1890, then went on to provide that the purchasers of said property should pay the judgment so awarded against the Sheffield and Birmingham Coal, Iron and Railway Co., within twenty days from the decree, and in default thereof that an order for a resale of said property might issue.

See Transcript of Record, pages 28 and 29.

4. As to Exceptions to Master's Report.

The Supreme Court of the United States have never held that appeals from decrees of circuit courts, wherein is called in question a judgment sustaining or overruling the finding of a Master's report, will not be considered unless it appears that objections were taken to the Master's report before the Master himself, and that he was given an opportunity to correct or change his findings. In the case of Story vs. Livingston, 13 Peters, at page 366, the court says: "Strictly in chancery practice, though it is different in some of our States, no exceptions to a master's report can be made which are not taken before the Master." Further down on the same page the court says: "But without restricting exceptions to this course, we must observe that exceptions to a report of a Master must state article by article those parts of the report which are intended to be excepted to."

The practice in the Circuit Court of the United States for the Northern District of Alabama is not for Masters to serve drafts of their reports, and thus give an opportunity to follow out the strict line of practice contended for in the brief of counsel for appellees. And where it is not the practice for Masters so to certify drafts of their reports the rule is that the exceptions must be filed within one month from the date the Master files his report in the clerk's office.

Hatch vs. Indianapolis, etc. R. R, 9 Fed. Rep., 856;
Fidelity Insurance Co. vs. Shenandoah Iron Co., 42 Fed. R., 372;
Jennings vs. Dolan, 29 Fed. Rep., 861.

In this case the exceptions came within the rule requiring that they should be filed one month after the Master's report was made; and they did specifically point out the errors of

which they complained, and the testimony relied upon to show the error of the Master was referred to, so that the court could without difficulty find it.

The rule contended for by counsel for appellees was announced in Story vs. Livingston, 13 Peters, 359, in the year 1839. Equity rule 83, regulating Masters' reports, was promulgated by Supreme Court on 2d March, 1842.

Further than this the right or propriety of the court below to pass upon exceptions to the Master's report, at the time and in the manner it did, is clearly manifest upon considering the first words in the decree of Judge Pardee, on page 28 of the Transcript of Record: "This cause came on to be heard, as by agreement of counsel of file, on exceptions to the Master's report and was argued." The agreement referred to was made on the part of the appellees by R. C. Brickell and W. A. Gunter, the counsel who now file this motion to dismiss on the part of the appellees. See Transcript of Record, page 23.

5. In view of the foregoing it is deemed unnecessary to enter into any discussion as to the merits of the case, further than respectfully to insist that at the proper time counsel hope to demonstrate to this court that the finding of the Master and the decree of the court below sustaining such finding were palpably erroneous.

HENRY B. TOMPKINS,
for Appellant.

Atlanta, Ga., 24th April, 1893.

Office Supreme Court U. S.
FILED.
DEC 15 1893
JAMES H. McKENNEY,
CLERK.

RECORD CASE No. 14,142.

# SUPREME COURT OF THE UNITED STATES

October Term, 1893. Term No. 176.

SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY COMPANY,
Appellant,

vs.

GORDON, STROBEL & LAUREAU (LIMITED), COMPOSED OF FREDERICK W. GORDON, VICTOR O. STROBEL, LEWIS S. LAUREAU AND THOMAS G. BOYLE,
Appellees.

Appeal from the Circuit Court of the United States for the Northern District of Alabama, Northern Division.

*STATEMENT, ASSIGNMENTS OF ERROR AND BRIEF FOR APPELLANT,*

BY HENRY B. TOMPKINS,
Of Counsel.

*Filed* ..... *1893.*

RECORD CASE NO. 14,142.

# SUPREME COURT OF THE UNITED STATES

October Term, 1893. Term No. 176.

THE SHEFFIELD & BIRMINGHAM COAL, IRON & RAILWAY COMPANY,
Appellant,

vs.

GORDON, STROBEL & LAUREAU (LIMITED), COMPOSED OF FREDERICK W. GORDON, VICTOR O. STROBEL, LEWIS S. LAUREAU & THOMAS G. BOYLE

Appeal from the Circuit Court of the United States for the Northern District of Alabama.

*STATEMENT OF THE CASE,*
*ASSIGNMENTS OF ERROR, and*
*BRIEF OF LAW POINTS.*

## STATEMENT.

During the progress of the foreclosure suit of Central Trust Company of New York against The Sheffield & Birmingham Coal, Iron & Railway Company, pending in the Circuit court of the United States for the northern district of Alabama, at Huntsville, Gordon, Strobel & Laureau, appellees, did on the 14th day of February, 1889, file their intervening petition as contractors and furnace builders, to recover from appellant a balance, as stated in said intervention, of $60,312,-

66, besides interest, which it was alleged had preference and priority over the mortgage or deed of trust given to said Central Trust Company by the appellant. This claim of the appellees was made as such furnace builders under a contract whereby they agreed to construct, for the predecessor of appellant, three iron blast furnaces at Sheffield, in Colbert county, Alabama, for $564,000, ninety per cent of which amount was to be paid from time to time during the construction of the furnaces, and which ninety per cent had been practically paid as agreed between the parties; the claim of appellees being the balance, together with some amounts alleged to have been paid out by appellees for excess of freight charges and upon material furnished to repair and reconstruct one of the furnaces, and which freight charges and bill for material ought to have been charged to or paid by appellant.

On the 23d day of April, 1889, the Central Trust Company of New York; Sheffield & Birmingham Coal, Iron & Railway Co.; J. G. Chamberlain, receiver; and one C. D. Woodson, who had been made a party-defendant to the bill of foreclosure of Central Trust Company of New York against Sheffield & Birmingham, Coal, Iron & Railway Co., filed their joint and several answers to the intervening petition of appellees. In this answer a consolidation of the company originally making the contract for construction of the furnaces was admitted; but the respondent, appellant in this court, demanded "strict proof of every matter and thing set forth and alleged in said petition whereby the claim or lien of said petitioner is sought to be established." It was also admitted that the Sheffield & Birmingham Coal, Iron & Railway Company had thereby become liable for whatever amount was due Gordon, Strobel & Laureau by the original Alabama & Tennessee Coal and Iron Company. The answer further set forth that F. W. Gordon, one of said Gordon, Strobel & Laureau (Limited), undertook to supervise and superintend the blowing in of one of the three furnaces, known as Furnace A, on the 17th August, 1888, and that said blowing in, management, custody and control of said furnace was put in charge of said Gordon,

who continued in said management for the space of nine days, during which time only one hundred and six tons of pig iron were made by said furnace; and that then, said furnace being utterly ruined and disabled, said Gordon himself abandoned said furnace and advised the executive officers of appellant that he could do nothing with it, and the said furnace was utterly ruined for all purposes of making iron so that it had to be shovelled out and said furnace repaired at a large outlay of time and money, to the damage of the Sheffield & Birmingham Coal, Iron & Railway Co. to an amount of at least one hundred thousand dollars. That the appellant, in order to repair said Furnace A, expended the sum of $5,152,-87, and that the iron made by said Furnace A during the nine days it was in charge of said Gordon cost the appellant $60.90 a ton, when the iron ought to have been made at a cost not exceeding $12 00 a ton, thus occasioning an additional loss to appellant of over five thousand dollars.

That after said Gordon had so ruined Furnace A, he then proceeded to blow in Furnace B, on the 7th September, 1888, and that after said Gordon remained in control and management of said Furnace B for sixteen days, and made about seven hundred tons of pig iron, an average of about forty-three tons per day, at a cost of about twenty dollars per ton for said pig iron, said Gordon was asked to relinquish the control of said Furnace B (it was then in a very bad condition) and which he did relinquish on the 27th day of September, 1888. That said Furnace B from its relinquishment by said Gordon to the officers of appellant was in such condition that, in order to prevent it from being ruined as said Gordon had ruined Furnace A, it required about six months to get said furnace in good condition, its hearths having been filled up and being otherwise damaged and disabled, and that the loss to appellant by reason of the action of said Gordon in respect of said Furnace B amounted to about ten thousand dollars; this amount being made out with the decrease of the out-put of iron, in expenses for labor and material in bringing said furnace to a proper working condition.

That said three furnaces were not built and constructed according to the plans, specifications, agreements and under-

takings set forth in said contract in various ways, which is shown in transcript of record, pages 17 to 19 inclusive; and that to put the furnaces in proper condition, as they ought to have been constructed, would have required an outlay of about $54,600.

The answer further set forth that the appellant was not liable or chargeable with the item of $9,618.16, as charged in the intervening petition of appellees as freight excess payments as per clause of the specifications and contract, which clause is found in the specifications for the construction of the three furnaces in transcript of record, page 7, side page 11.

It is also set up in said answer that appellant was not liable or chargeable for the further sum of $1,194.50 for extra material furnished September 21, October 16, and October 29th, 1888, as per the first statement which is referred to in transcript of record page 19, side page 32; and also in the intervening petition, transcript of record page 4, side page 6.

Appellants afterwards amended their answer, as set forth in transcript of record pages 21 and 22, side pages 36 and 37, alleging that said three furnaces were constructed in so faulty, inadequate and improper a manner that unlike the two other furnaces at Sheffield and other furnaces properly constructed elsewhere, said furnace plant of three furnaces could not be operated so as to make steam by consuming the gases under the boilers as is ordinarily done in modern furnaces of improved pattern and construction, and it became necessary in order to make steam for said furnaces, or one of the furnaces while in operation, to consume three hundred and fifty to five hundred pounds of coal for each ton of iron made, so that each ton of iron was made at a cost of from forty to fifty cents more than it ought to have cost per ton, and thus the average daily expense of operating each of said furnaces was over fifty dollars more than would have been the case if said Gordon, Strobel & Laureau had properly constructed said furnaces.

Appellants further set forth in said amended answer that by the evidence adduced at the hearing before the special master in chancery, that after running one furnace twelve

months it has been practically demonstrated that it costs over twenty thousand dollars more to operate said furnaces per annum than it would have cost if said furnaces had been properly constructed so as to save said consumption of coal under the boilers.

Appellants sought further to amend their answer, as set forth on pages 20 and 21 of transcript of record; which amendment was not allowed by the Honorable Don A. Pardee, circuit judge, on the 12th June, 1890.

In this amendment so disallowed by the court, it was alleged that Gorden, Strobel & Laureau (Limited), was an incorporated company, organized under the laws and statutes of the state of Pennsylvania, and was a corporation foreign to the state of Alabama. It was also alleged that the proposition of appellees to construct the three furnaces was made on the 9th February and accepted on or about the 1st March.

It was further alleged that the corporation of Gordon, Strobel & Laureau (Limited) had failed to comply with the constitutional statutes of the State of Alabama by filing with the secretary of state a statement in writing as to incorporation and the place of business in Alabama; and had specially failed and refused to comply with the act of the general assembly of Alabama passed on the day of February, 1887.

The evidence before the special master in chancery was begun to be taken on the 11th day of September, 1889, and was not entirely completed until the 19th day of July, 1890, and is to be found in transcript of record pages 44 to 317 inclusive.

It was not disputed, but indeed was shown by the account submitted by the intervenors, that the appellant had paid $514,500 of the original contract price for the three furnaces of $564,000, leaving unpaid the sum of $49,500. The claim of appellees beyond that amount was $9618.16 for freight excess payments, and $1194.50 for extra material furnished on the 21st September, 16th October and 29th October, 1888. Both these last amounts aggregating $10,812.66 were disputed by appellant upon the ground that the excess in payment of freight over thirteen and one-half cents was

tons in proportion to the per centage of metallic iron in the ores between fifty and forty-five per cent." See transcript of record p. 7, side p. 11. These maximum outputs of one furnace in thirty consecutive days were to be guaranteed, provided an additional $20,000 was paid to the contractors over and above $564,000 stipulated as the price that said three furnaces were to cost, and it was expressly stated lower down in said proposition that it was given as a guarantee of the performance of one furnace, and to establish the merits of said furnace as to product. It is thus obvious from the context of the written proposition of Gordon, Strobel & Laureau, that they undertook and agreed to construct three iron blast furnaces, according to plans and specifications therein given, and which were not afterwards changed or modified, each of which furnaces was to be capable while running together and at one time, of an output of from 3600 to 4200 tons of pig iron for each furnace in thirty consecutive days, provided the per centage of metallic iron in the brown hematic ores should be from 45 per cent to 50 per cent. (See transcript of record page 6 to 8 inclusive.

The Alabama & Tennessee Coal & Iron Co., in accepting the proposition to have the three furnaces built, although they did not accept that part of the proposition by which they were to pay $20,000 additional for the guarantee of that special output, yet understood and were informed that the three iron furnaces, constructed to be operated together, were built with the agreement on the part of the builders and contractors, that the plant, as a whole, should be capable of the above stated output of iron. It was clearly not intended or contemplated by any party to the contract, that the three furnaces should not be operated together, or that if only one of them was operated at a time, that it should require more than one-third of the boiler and engine power to keep it going.

The fact that the Alabama & Tennessse Coal & Iron Co. did not agree to pay the $20,000 additional, over and above the contract price for a practical demonstration of the above specified out-puts of iron while the furnaces were being operated for thirty days by Gordon, Strobel & Laureau, does not

at all withdraw from the contract, as a whole, that the furnaces were to be "adequate in design, strength, capacity and workmanship, for the purpose for which it is intended."

It is true that the proposition to construct the three furnaces embodied in it the following: "Your superintendent shall pass upon the work every two weeks, and if to his satisfaction, it shall be finally accepted by you, so far as done. But if not in compliance with the contract and to his satisfaction, as to quality of material or character of workmanship, we agree to make it so as rapidly as possible." (See transcript of record, page 7, side page 11). These are the only words in the proposition that could possibly be tortured into meaning that the furnaces were not to be such as all three working together would produce from 3600 to 4200 tons of pig iron each for thirty consecutive days, with the character of the ores as above stated. But a careful consideration of all the terms of this proposition shows conclusively that it was the meaning and intent of the intervenors, Gordon, Strobel & Laureau, that they would construct three furnaces, to be operated together, each of which should have a daily out-put of 120 to 140 tons of pig iron; and that each of the furnaces should be operated with one-third of the boiler and engine power supplied for the whole plant; and that the expenses of operating this plant, either all three at once, or one or two furnaces at a time, should not be greater than the expense of operating well built, properly constructed first class furnaces upon a modern standard of production and output.

Suppose, after the clause first above mentioned—which we contend is clearly a guarantee as to "design, strength, capacity and workmanship"—the contractors had put in a proviso somewhat as follows, viz: "But it is understood that if the boiler and engine power is not sufficient, upon a practical test, to work all three furnaces at once, or that it will take half the boiler and engine power to operate one furnace; or that it will require to be burnt under the boilers from forty to fifty cents worth of coal to make a ton of iron, over and above what the other two furnaces at Sheffield require to a ton of iron, because of faulty construction, so that the gas

does not make sufficient heat to operate with, then the contractors are not to be held liable for any defects or shortcomings of the furnace plant." Is it to be supposed for a moment that the Alabama & Tennessee Coal & Iron Co., now represented by the Sheffield & Birmingham Coal, Iron & Railway Co., would have accepted such a proposition, or would have paid out one cent toward the construction of furnaces, with such an understanding? Yet the whole contention for the intervenors in this case rests upon the idea that the proposition submitted by them, to construct these furnaces, should be so construed as if that proviso were in the writing.

Much stress has been laid by the intervenors upon the fact that furnace plant was accepted by Edward Doud, superintendent, about 8th August, 1888. This action of Doud was the result of instructions from E. W. Cole, president of the company, and was required by Gordon, Strobel & Laureau before they would proceed with their written obligation to blow in one of the furnaces. This acceptance by Doud amounted to nothing, in any possible view of the case, because he had already, from time to time, accepted the work as it progressed, which was the only acceptance stipulated for in the contract, where it is stated that such acceptance by the superintendent shall be "final acceptance by you, so far as done." And it is a fact that this biweekly acceptance was all that was required by the contract and amounted, in every way, to as much as an acceptance by Doud of the whole plant, upon its completion on 8th August, 1888. Indeed, the acceptance, according to the very terms of the contract, amounted to nothing other than that the Sheffield & Birmingham Coal, Iron & Railway Co. could not, thereafter, contend that the work was not done in a good and workmanlike manner and of suitable material. But said acceptance was in no wise a waiver, on the part of the company, of any right to avail itself of the guarantee given by the contractors, "that each part should be adequate in design, strength, capacity and workmanship for the purpose for which it is intended." That such was the contract is rendered still more apparent by reference to the clause stating that ten per cent of the whole contract price of the furnaces should be reserved and paid

after their completion:" $6,400 within thirty days after the full completion of the contract, $50,000 balance in the company's paper at four, eight and twelve months, each note being for $16,666.66 and bearing interest at the rate of 6 per cent per annum from their dates." See transcript of record, page 8, side page 12. It was contemplated that not until after thirty days from the full completion of the contract was this ten per cent to be arranged for, and by the contract its full completion on the part of the contractors was not to be considered as taking effect, in so far as the right to demand payment was concerned, until "we shall give each of the three furnaces as put in blast our personal attention, supervising their operation and attain for you as perfect action and as high a duty as we can."

But what seems conclusive in favor of the appellant against the right of appellees to recover more than the ninety per cent which was paid during the construction of the furnaces, unless the furnaces should be in each and every part "adequate in design, strength, capacity and workmanship for the purposes to which it is intended," is made entirely manifest by the following clause in the proposition submitted Gordon, Strobel & Laureau: "Neither are the monies remaining in your hands, after paying us ninety per cent of the contract price, nor the additional twenty thousand dollars, shall become due until the product as specified has been attained, but when it is attained then you are to pay us the full amount, viz: $76,400 in money and notes as above stated." See transcript of record page 8, side page 12.

Under the evidence before the master there was not even any conflict but that the furnace builders utterly failed to make either of the two furnaces blown in by them under the direction and management of their Mr. Gordon, come up to the standard of production guaranteed; but so far from this the first furnace was utterly ruined and had to be built over and the second furnace was abandoned by Gordon after days of trial, on the eve of also being ruined, and upon no single day was the output of iron up to the guaranty. See Transcript of record pages 193 to 195 inclusive, side pages 280 to 282.

To show that appellees considered it encumbent upon them to demonstrate the capacity of the furnace plant to make iron, reference is made to their petition and intervention, filed in this court, where under the 11th section, they say "prior (subsequent) to 8th August, 1888, petitioners gave personal attention to putting into blast the furnace designated A," and thereafter, on or about 7th September, petitioners gave personal attention to putting into blast the furnace designated as furnace "B," and petitioners supervised the operation of said furnaces attaining for them as perfect action and as high a duty as they could. On 5th September, 1888, petitioners notified said company that so soon as furnace "B," was put into blast, they would be ready to give personal attention to putting in blast furnace "C," and supervising the same, and would expect said company to go on with the work. But that said company refused to put said furnace into blast, or to designate any time for putting the same in blast; and has not designated any time for putting same in blast, or afforded your petitioners an opportunity of giving personal attention to the same." See transcript of record, page 5, side page 7.

Here we have an express admission, in the pleading of the intervenors, that it was a part of the contract, and some thing necessary to be done before they had a right to require the payment of the last ten per cent, that the intervenors should supervise the putting into blast of each of the three furnaces; and as a condition entitling them to begin an action they thought it necessary to allege a reason why they did not put the last furnace into blast, being because the furnace company would not permit them to do so.

These various constructions of the contract, in the light of the proposition as submitted, and the pleadings of intervenors, the master in chancery wholly failed to comprehend. But looked at the case as if Gordon, Strobel & Laureau were entitled to a final settlement thirty days after 8th August, 1888 when the mechanical work upon the furnaces was completed (see report of master in chancery, and statement of account thereto annexed); Transcript of record pages 24 to 26 inclusive, and the master in chancery further seems to have

considered that if the specifications upon which the furnaces were constructed did not include sufficient power to run the three furnaces, that the misfortune of that was to be vlsited upon the furnace company for whom the furnaces were constructed; and was not the fault or the mistake to be visited upon the contractors, who guaranteed that certain appliances would effect certain results. With great respect for the master in chancery, and the court in confirming his report and findings, we cannot but contend that the master and the court totally misconceived the scope and object of contract to construct the furnaces, as they narrowed everything down simply to a question as to whether or no such building, erections, machinery, etc. had been put together as the specifications called for, and as that was virtually admitted to be done. By the finding of the master and the decree of the court below, the whole responsibility resting upon the intervenors was simply to construct something after the manner and form of their specifications, and this relieved them entirely from any statement or guarantee, expressed or implied, as to the effectiveness or worth of the furnaces when put to the actual test of making iron.

A cardinal rule of law is that a person undertaking to erect certain buildings, machinery and appliances that he states will effect, when in operation certain results is bound to comply with his contract, or suffer such damages as flow from his failure to accomplish what he undertakes. Yet the master and the court below, wholly failed to perceive any such legal principle applying to the facts before them.

In the light of such legal principles as will certainly apply in this case, it remains to be conside ed what the proofs taken by the master in chancery show concerning the failure of the intervenors to comply with their contract; and the damages to which the defendant, the Sheffield & Birmingham Coal, Iron & Railway Company, is entitled:

1st. The petition of intervenors, as hereinbefore set forth, admits that they attempted to attain for two furnaces as perfect an action and as high a duty as they could. And along with this admission comes the further admission that it was their duty under the contract to blow in the furnaces. Now

it is not disputed by anybody, or anywhere in the testimony that F. W. Gordon, one of the contractors, while in exclusive charge of furnace A, and furnished with such materials as he contracted to have, not only totally failed to make anything like 120 tons of iron per day; not only totally failed to operate one furnace with less than about 1-2 of the boiler and engine power designed for the operation of the three furnaces; not only failed to operate one furnace with less coal under the boilers than would make the iron cost from 40c to 50c per ton more than if the boilers could have been operated with the gases, as they should have been; but that said Gordon ruined Furnace A in less than ten days, so that he himself advised its abandonment and that it had to be pulled down and reconstructed, at a cost of about $7,000. In the testimony adduced for the intervenors, notably that of this same Gordon, and E. Dowd, superintendent, who assisted him in blowing in this furnace, it is stated that with proper management one furnace could have been run with 1-3 boiler and engine power, and without an outlay of coal necessary to make heat in addition to the gases and that the furnace ought to have produced an average of 125 tons of pig iron per day. This theoretical testimony is contradicted not only by most of the evidence offered by defendant, but by the fact that Gordon and Dowd did not bring the furnace "to as perfect an action and as high a duty," as it was brought to by Mr. Chamberlain, and they not only failed to do this, but actually ruined the furnace in their efforts to make iron. See transcript of record pages 193 to 195 inclusive.

2d. The evidence further discloses that Gordon and Dowd took possession of the second or furnace B, and while in charge of that furnace for a good many days were totally unable to operate it with less boiler and engine power, and with less coal than they used in operating the first furnace while making the same amount of iron, and still failing to make half of what they both said the furnace should average per day, namely 125 tons. This furnace when admitted to be in a precarious condition by these two parties who were operating it, was voluntarily relinquished and put in possession of Mr. Chamberlain, who brought it round, and continued to

operate it for about twelve months with very fine results, so far as the quantity of iron is concerned, but without the possibility, after very many trials and experiments, of running this furnace with less than the same amount of boiler and engine power, and same quantity of coal that Gordon and Dowd found it necessary to operate it with. See transcript of record page 196, side page 282–283. It is a little singular that Gordon and Dowd, and their witnesses, have the effrontery to testify under oath that it was bad management on the part of Chamberlain and his employes which made it necessary to use more than 1-3 of the engine and boiler power and the quantity of coal that it was found necessary to run this furnace; considering the fact that Gordon and Dowd, after ample opportunity, had not only failed to do better than Chamberlain while using what they themselves swear is the best coke, viz., Pocahontas, but had failed to do half as well as Chamberlain in quantity of iron, while having better materials for the furnace.

3d. It appears that appellant, without further extending the statements of fact in this case, is very clearly entitled to the following amounts to be taken from what is claimed by intervenors:

(a) The sum of $1,194 50, for material furnished by Gordon, Strobel & Laureau to reconstruct the first furnace which was ruined by Gordon, as this material was not furnished under contract upon which he has contended, but was furnished without reference to that contract, and after he had ruined the first furnace. See transcript of record, pages 46–55.

(b) The amount of $6,726.58, shown by the testimony to have been expended in the reconstruction of this Furnace A. See transcript of record, page 194.

(c) The amount $10,000, which the testimony shows would be required to put in an additional engine, in order that all three furnaces could be operated together. See transcript of record, page 191.

(d) The amount of $22,500, which the evidence shows will be required to add to and enlarge the boiler power so

that all three furnaces could be run together. See transcript of record, page 189.

(e) The amount of $50,000, which the evidence shows was lost by running the furnace because of having consumed from 40c to 50c per ton of iron under the boilers beyond what ought to have been consumed in a properly constructed plant. See transcript of record, page 195.

(f) Or the court could allow $100,000, the amount the evidence shows would be necessary so to modify and reconstruct the boilers and engines as to make the furnace plant valuable and effective as it was designed and guaranteed to be. See transcript of record, page 195.

In any event the whole amount found for the intervenors should be written off and a decree rendered either generally for the appellant, or a decree rendered in favor of appellant for about $50,000 beyond the ten per cent withheld under the contract.

The court below, Honorable Don A. Pardee, presiding, seemed to have directed its attention to but two points in the case. See transcript of record, pages 28, 29. These were, that the work of construction of the furnaces as they progressed had been accepted by Edward Doud, as superintendent of the furnace company; that, therefore, in the contract made between the contractors and the furnace company the contractors "did not guarantee that the work or plant as a whole was adequate in design, strength capacity and workmanship for the purposes intended and specified;" therefore, the finding of the master was right and the exceptions to his report should be overruled and the report in all respects confirmed.

Just how the court could have made this finding in view of the express guaranty by the contractors set forth in their proposition to construct the furnaces can be accounted for only upon the assumption that the cause was submitted to the circuit judge upon briefs without oral argument, and that he failed to have his attention directed to that part of the proposition of Gordon, Strobel & Laureau found in transcript of record, page 7, side page 11, as follows:

"In compliance with these specifications we will furnish

all the material and construct for you three blast furnaces on a suitable location in Sheffield, Alabama, to be selected by you; all work to be done in good workmanlike manner and

entirely overlooked both by the master in chancery and the court, viz: 1. That the furnaces were to be adequate, etc., for the purposes to which they were intended; that is, the three furnaces were to be operated at once and were to have an output of not less than 120 tons of pig iron per day; or, if one of the furnaces could be operated singly with one-third of the power designed for the three: And, 2. That if the product of the furnaces, or one of them, should not be attained as specified that the ten per cent of the contract price held by the furnace company, the appellant in this cause, was not to become due or payable.

that all three furnaces could be run together. See transcript of record, page 189.

(e) The amount of $50,000, which the evidence shows was lost in ruining the furnace because of having to use from 300 to 500 pounds of coal under the boiler in making each ton of iron, when no coal at all or very little should have been used if the plant had been properly constructed so as to burn the gases under the boiler. This defect making each ton of iron produced cost from 40c to 50c per ton more than it should. See transcript of record, page 195.

for the appellant, or a decree rendered in favor of appellant for about $50,000 beyond the ten per cent withheld under the contract.

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Just how the court could have made this finding in view of the express guaranty by the contractors set forth in their proposition to construct the furnaces can be accounted for only upon the assumption that the cause was submitted to the circuit judge upon briefs without oral argument, and that he failed to have his attention directed to that part of the proposition of Gordon, Strobel & Laureau found in transcript of record, page 7, side page 11, as follows:

"In compliance with these specifications we will furnish

all the material and construct for you three blast furnaces on a suitable location in Sheffield, Alabama, to be selected by you; all work to be done in good workmanlike manner and suitable material, *and each part to be adequate in design, strength, capacity and workmanship for the purposes to which it is intended.*"

Further, in the same proposition submitted by the furnace builders, appellees in this cause, in transcript of record page 8, side page 12, it was agreed and contracted that "neither are the monies remaining in your hands after paying us 90 per cent of the contract price" (this being $56,400, being ten per cent of the price of $546,000 not including the $20,000 for the additional guaranty which was never entered into) "shall become due until the product, as specified, has been attained." So, then, there were two most important points entirely overlooked both by the master in chancery and the court, viz: 1. That the furnaces were to be adequate, etc., for the purposes to which they were intended; that is, the three furnaces were to be operated at once and were to have an output of not less than 120 tons of pig iron per day; or, if one of the furnaces could be operated singly with one-third of the power designed for the three: And, 2. That if the product of the furnaces, or one of them, should not be attained as specified that the ten per cent of the contract price held by the furnace company, the appellant in this cause, was not to become due or payable.

## ASSIGNMENTS OF ERROR.

Counsel for appellees assign errors and say that the court erred as follows:

1. In decreeing as set forth in transcript of record pages 28 and 29.

2. In decreeing that the contract between Gordon, Strobel & Laureau and Sheffield and Birmingham Coal, Iron and Railway Company, wherein appellees undertook to construct the three iron blast furnaces of appellant, did not guarantee that the work or plant as a whole should be adequate in design, strength and capacity for the purposes intended and specified.

3. In decreeing that the exceptions to the special master's report be and the same are overruled, and that the said report be and the same is confirmed. Said exceptions being found in transcript of record, pages 26 and 27.

4. In decreeing, by sustaining special master's report and overruling the exceptions, that the defences set up by appellant were not sustained by the evidence submitted to the master.

5. In decreeing, by sustaining the special master's report that the petitioners, Gordon, Strobel & Laureau, were entitled to be paid the contract price for their work on the furnace, the freight excess charges and material, as claimed by them in their intervening petition, to-wit, the sum of $57,808.12, with interest from the 18th September, 1888, at the rate of eight per cent per annum.

6. In decreeing, by sustaining the report of the special master, that the sum of $7,113.62 was due from appellant to appellee for freight excess payments, finding the same a lien against the property of appellant at Sheffield, Alabama, prior in right to the lien of the bonds secured by the mortgage foreclosed by Central Trust Company of New York against Sheffield and Birmingham Coal, Iron and Railway Co.

7. In decreeing, by sustaining the report of the special master, that the sum of $1,194.50 was due from the appellant to the appellee for extra material furnished after the construction of the furnaces, and making the same a charge against the property of appellant and a lien thereon prior in right to the lien of the bonds secured by the mortgage foreclosed by Central Trust Company of New York.

8. Appellant further assigns errors and says that the court erred because the court did not find and decree that the exceptions to the report of the special master filed by appellant were well taken, and that said report and findings of said master in chancery should be set aside and disallowed.

9. Because the court did not find and decree that, under the evidence adduced before the special master, the appellees were not entitled to have any lien of any kind upon the property of appellant, because it appeared from said evidence that appellees had not complied with their contract and guaranty wherein they undertook and agreed that the three iron blast furnaces at Sheffield, and each of them, should in all their parts be adequate in design, strength, capacity and workmanship for the purposes to which they and each of them were intended.

9. Because the court erred in not finding and decreeing that no sum of money whatever was due by appellant to appellees under the evidence taken before the special master because it conclusively appeared from such evidence that the said three iron blast furnaces, nor either of them, had attained the product in the making of pig iron as specified in the contract, agreement and guaranty submitted by appellees to appellant, to wit: That the product of thirty-six hundred tons in thirty consecutive days should be the output of any one of said furnaces; or a product of between forty-two and thirty six hundred tons should be the product of any one of said furnaces in proportion to the percentage of iron in the ores between fifty per cent and forty-five per cent.; when it was conclusively shown by the evidence that appellant had furnished to appellees the ores containing the

proper percentage of metallic iron, and also the coke and limestone of the kind and character required by said appellees.

10. Because the court erred in that it did not find and decree in favor of appellant on all the issues submitted, to wit: That the appellees were entitled to recover nothing whatever against appellant, or to any lien upon the property of appellant for any amount due in the construction of said three iron blast furnaces at Sheffield.

11. Because the court erred in finding and decreeing any lien whatever in favor of appellees against the property of appellant, because neither in the pleadings nor in the evidence introduced before the master in chancery nor in his report to the court was there any paper or writing showing that appellees had filed their claim of lien in the office of the judge of probate for Colbert county, Alabama, where the three iron blast furnaces are situated; or that said claim of lien had been recorded in said office of said judge of probate as required by law.

12. Because the court erred in finding and decreeing any lien in favor of appellees against the property of appellant, because the only statement made or evidence introduced by appellees showing a compliance with the statutes of Alabama requiring the original contractor to file his claim of lien in the office of the judge of probate of the county in which the property upon which the lien is sought to be established is situated, was a statement in the original petition of appellees that a copy of the claim and statement was filed in the office of said judge of probate is herewith filed and marked C. D. and prayed to be taken as a part of said petition, said statement being found on page 6 of the transcript of record. And the further showing by appellees as to compliance with said section of said code being the affidavit of one James C. Gray set forth on pages 9 to 12 in the transcript of record. But that in neither of said references or statements was it shown that said affidavit of said James C. Gray, marked C. D., had ever been filed or recorded in the office of the judge of probate of Colbert county; but the same

was shown only to have been filed in the clerk's office of the circuit court of the United States for the northern district of Alabama on the 11th February, 1889.

13. Because the court erred in finding and decreeing any lien in favor of appellees against the property of appellant situated in Colbert county, Alabama; because the court was without jurisdiction to fix a lien prior in right to the bonds secured by the mortgage of Central Trust Company of New York then foreclosed, unless it shall have affirmatively appeared in the pleadings or the evidence before the master in chancery by proper certificate from the judge of probate of Colbert county, Alabama, where the property on which the lien so sought to be established was situated, that appellees had actually within six months from the 8th day of August, 1888 filed their claim of lien in the office of said judge of probate as provided by section 3022 of the Code of Alabama of 1886, and that the same had been recorded under sec. 3024 of said code.

14. Because the court erred in finding and decreeing any lien in favor of appellees against the property of appellant situated in Colbert county, Alabama, because the court was without jurisdiction to find or decree any such lien until it shall have been made affirmatively to appear to the court by the pleadings and proof that appellees had complied with all the requisites of the Code of Alabama of 1886, providing for the acquiring and enforcement of the liens of mechanics and contractors.

## BRIEF OF LAW-POINTS AND ARGUMENT.

The petition of the appellees and the answers of the appellant constitute the pleadings in this matter. The decree of reference to the special master was the guide by which he should direct his inquiries—proceeding to such inquiries by the forms and in the manner usual in courts of law, being governed by legal principles.

The issues in the case are formed by the pleadings, and the burden of proof on such issues is where the pleadings under well established rules of law place it.

The petition of appellees base their right to recover upon a written contract made between them and S. & B. C. I. & R'y Co. on the 9th of February, 1887. After setting up the contract (transcript of record, pages 6, 7, 8, 9) they aver a complete performance thereof by themselves, and an acceptance of the work by the contracting appellant.

The appellant in the first clause of its answer to said petition demand strict proof of every fact alleged in said petition necessary to the establishment of appellees' claim or lien. Transcript of record, page 15, side page 25.

The answers then proceed to set out specifically the matters wherein it is claimed that the contract has not been complied with. Transcript of record, pages 15 to 20 inclusive; and 21 and 22.

Now then, what kind of an action have we by the pleadings, what are the issues, and where is the burden of proof on the issues?

If appellees' right to recover exists, it springs out of a written contract which has been performed by them and broken by the appellants. If this proceeding was in a court of law where greater strictness in construing pleadings exists, the appellees would be held to proving a substantial compliance in every material respect with their undertaking before a recovery could be had. Their petition, as it is, is but a declaration with a special count on the contract, confining them to the recovery of a *quantum valebant*. If common courts were also added to such a complaint the appellees could under them recover a *quantum meruit* on showing the

performance by them of work which was accepted and received by the contracting appellant. We apprehend that a court of equity will without regard to the technical rules of construing pleadings look at the facts stated and apportion relief according to the justice of the case. Measuring appellees' attitude by this liberal rule we find them claiming under a contract either a *quantum valebant* or a *quantum meruit.*

If a *quantum valebant,* then they must show a compliance with every material undertaking on their part by themselves, and breach by the contracting appellant of its undertaking.

If a *quantum meruit* is sought, then they must show that work and labor were done by them and materials furnished which were accepted by the contracting appellant. In either aspect the burden is the appellees. The appellant's denial is the creation of the general issue. Their specific allegations are nothing more than special pleas. The whole matter is to be solved by the proof under the inquiry whether the complainants, appellees in this court, have made out their case.

Great stress is laid upon the fact by the appellees that the plant was accepted and received by the appellant.

The question as to whether or no there was a guaranty as contended for by appellant the special master in his finding and report did not seem to think necessary to pass upon, and he makes no reference whatever to the legal force and effect of the words heretofore quoted from the proposition of Gordon, Strobel & Laureau to the predecessor of appellant, and which is found in transcript of record page 7. Nor did the special master at all refer to the words in the same proposition, to be found in transcript of record page 8, where the appellees stipulated that the monies remaining in the hands of appellant after paying ninety per cent of the contract price should not become due until a certain product as specified should have been attained by the furnaces. Judge Pardee in his decree confirming the special master's report did deem it necessary to pass upon this queston of guaranty and decided it against the contention of appellant. See transcript of record page 28. This decree so finding against the guaranty contended for seems to have been based upon the sole ground

that it appeared from the evidence that there had been a bi-weekly acceptance of the work upon the furnaces as it progressed, and that there had been an acceptance by the appellant's superintendent after the work was completed.

The acceptance of the plant from week to week as being substantially constructed, and out of the proper material, in no wise affected or annulled the express guarantee that such structures when completed, and put into actual use, should answer and be "adequate in design, strength, capacity and workmanship for the purpose to which it is intended."

One of the expressed purposes [transcript of record, page 8,] was the production of a specified quantity of pig iron by each furnace in 30 days operation. Another of the obviously implied, if not expressed, purposes was that all three of the furnaces could be operated at once with the stack house, engines, boiler, etc., as they were built.

Then if the product as guaranteed should not be attained, it was definitely stipulated [transcript of record, page 8,] that the unpaid monies, to-wit 10 per cent of the whole cost, should not become due.

There are two reasons why the alleged acceptance by the contracting defendant does not have the effect of shutting off the defendants from their relief for the failure of the plaintiffs to build the plant as contracted: or to have the furnaces attain the output of iron, in the operation of the plant, as guaranteed in the contract of construction.

First. The rule is well settled that the acceptance of work built under a written contract does not estop the owner from showing a non-compliance by the builder with the contract and corresponding damage to him. The effect of his acceptance is to hold him liable on a *quantum meruit*.

Chitty on Con. Vol. 2 (11 Ed) pp. 825 and 826; and note to pps. 826-7-8 and 9:
Thomas & Trott vs. Ellis & Co. 4 Ala. 108:
Meriwether vs. Taylor 15 Ala. 739:
Hawkins & Gilbert vs. Maddox 19 Ala. 55.

Phillips on Mechanics Liens, 2 Ed. - Secs 142, 135, 134, 136.
2 Sutherland on Dam: " " 702

Thereby evidence as to real value of Furnace plant showed it to be $350,000. —
Transcript, p. 200. C. p. 278.

See also the case of Bell vs. Teagle, 85 Alabama, p. 211. In this case the doctrine is laid down that where a person accepts a building, a mechanic's lien can be enforced for what the work was reasonably worth, if there were such defects as to render it worth less than the contract price. And by implication the doctrine is also set forth in this case that the acceptance of the work does not preclude the person for whom the building was constructed from showing such defects of construction as to reduce the price below that of the written contract—which is just what the defense in this intervention seek to do, with the further effort to offset and recoup, so that a judgment shall be rendered in favor of the appellant against intervenors, because the appellant has already paid a larger amount than the work was reasonably worth.

In the case of Cutcliff vs. McAnally, 88 Ala., 507, a mechanic's lien was enforced. In speaking of the obligations imposed upon the contractor to fully comply with his contract, the court says: "This is upon the settled principle that where one, by his own voluntary contract, creates a lawful duty or charge upon himself, he is bound to make it good, if he may (can), despite obstructions imposed by accident or inevitable necessity."

Second: the contract contains two guaranties of warranties. One of them a general guaranty applying to all the separate parts of the plant; the other a special warranty applying to the engines alone. Does the acceptance of work created under a guaranty destroy the effect of the guaranty? If so, the guaranty is a very useless feature of a contract The contract and specifications in this matter constitute but a single undertaking. The provision of the former is, bi-weekly inspections shall be had by the owner's superintendent of the work, and if he is satisfied, it shall be a final acceptance. But if he is not satisfied, what shall be done? They agree to satisfy him as to quality of material and character of workmanship. This provision plainly means that this inspection and acceptance applies to work of construction, and to such material necessarily used in the construction which is not and could not, by reason of its character and numbers, be specified in the contract. Under this provision of the contract it would have

been the duty of the superintendent to examine the quality of the brick and mortar and workmanship on the same and such like matters as pertained to the proper building, in the way of construction preparatory to erecting the machinery.

For instance, take the furnace shell, page 2 of specifications. This superintendent, under authority of such provision, could, and should, have passed on the brick and workmanship of the same that went into the construction of the furnace. He could have rejected bad material or poor workmanship. His acceptance of either would have been binding. Yet, can it be said that he had the right and power to alter the diameter of thickness of the iron shell? Certainly not. But suppose a test of the furnace, when put in operation, had developed that this shell was inadequate in design and strength and capacity (copy contract Transcript of Record p. 7, side page 11), for the purpose for which it was intended. Would the inspection and acceptance by the superintendent shut the defendants off from claiming damages for the defect? Certainly not. Again, take the alleged final acceptance after the completion of the furnace and determine its effect. Appellees claim that such final acceptance after completion and before operation of the works, has the effect to waive any defect or shortcoming in the machinery or plant. This position is not tenable. How could the "adequacy of design," "strength" or "capacity" provided for in the contract be determined or known until after the plant was put in operation. For illustration, take first the stock house, on page 19 of specifications:

It is not denied but that it was built in the manner and of the dimensions specified. The contracting defendant received it with that understanding, nor is it denied but that it is insufficient in capacity. Did its act destroy the force of the guaranty (Transcript of Record, p. 7,) that each part should be adequate in design, strength, capacity and workmanship? Again, take the engines (Transcript of Record, p. 36) Did the acceptance of them by the defendant destroy the guaranty that they would run well at a speed of 45 revolutions under constant regular work, and to a blast pressure of 10 pounds per square inch?

Appellees certainly mistake the principle applicable to such

cases, or confound it with the somewhat similar principle that the owner of a building in process of construction can expressly or impliedly assent to a change in the work from the terms of the contract, and by acceptance estop himself from setting up a non-compliance with the contract. Such is not this case. Here we say that although built as specified, certain parts of the machinery are short of the terms of your guaranty. You guaranteed your specifications. See proposition to construct furnaces, containing guaranty and specifications, on Transcript of Record, pp. 6 to 9 inclusive, and pages 29 to 43 inclusive.

## AS TO PROOFS.

Third;

Whether the appellees complied with their warranties or guarantees in the construction of the plant will have to be determined by a careful study of a large volume of testimony in many respects conflicting and contradictory.

We will in this argument consider a few of the many items of dispute, selecting such as are of material importance.

1. THE STOCK HOUSE. If we are correct in our contention as to the meaning and operation of the clause of the contract (transcript of record, page 7), it was guaranteed that this stock house should be "adequate in design, strength, capacity and workmanship for the purpose for which it is intended."

A stock house is intended to hold the stock for the plant. Its capacity is its holding or storing area. It was intended for the whole plant. The only testimony in reference to this

house is the depositions of J. G. Chamberlain (transcript of record pages 186, 187.) He shows that it will take $4000.00 or more to give this house sufficient storage capacity.

Certainly the master's report should have been corrected as to this amount.

2. The next item, or items, is the engines and boilers:

There is much testimony on these items. The appellants' contention is that the weight of testimony clearly shows that there is a deficiency in the boiler and engine capacity amounting in value from $30,000 to $35,000.

See J. G. Chamberlain's deps., transcript of record pages 177, 188 to 191, 220;
G. W. Killebrews deps., transcript of record, page 222;
A. McIlwain, deps., transcript of record, 223 to 226;
H. C. Brown, deps., transcript of record, 229, 230;
J. H. Partlow, deps., transcript of record, 241 to 243;
J. H. Murphy, deps., transcript of record, 244;
Fred Massey, deps., transcript of record, 245 to 248.

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These witnesses are all practical men who acquired their knowledge in the school of experience. Some of them are men of technical knowledge also. Their opinions are based upon actual test. There was no proof offered against their statements by any one who had seen the furnaces actually at work. On the contrary, both Gordon and Dowd, who blew in furnace A. and ruined it, and furnace B. and came near ruining it, admitted that they had found it necessary to use the same boiler and engine power in operating. The witnesses of the appellees are mainly scientific men. They unhesitatingly deny the conclusions arrived at by appellants' witnesses. Their denial is based upon their assumed scientific knowledge and not upon test. It is but the dogmatism of science arraying itself against actual experiment.

The master should have reduced appellees' claim to the extent of the value of sufficient boiler and engine capacity to work the furnaces as intended. The evidence shows this to be between $32000 and $35000.

3. The next matter of material importance is the arrangement for burning gas:

The testimony in the case shows that one of the purposes of construction is the utilization of the gases created as fuel for the operation of the furnace. There is a large amount of testimony on this point. It is not contradicted, however, but that it is necessary to use under these boilers from 400 to 500 pounds of coal to the ton of iron produced. The conflict is as to the reason or cause of the need of using it. The appellant maintains that such necessity is created by the improper construction of the arrangements for burning the gases. The appellees claim that the arrangements are all proper but that they are not properly managed. Again we find theory arrayed against actual test. In this particular instance, we find that some of the theorists Gordon and Dowd, were in charge of the furnace, and that their experience on the coal question was the same as that of appellants' witnesses.

It is not denied by appellees but that from 300 to 500 pounds of coal to the ton of iron produced was burned under the boilers; nor is it denied but that gas was constantly burning at the top of the boiler stacks. This gas could not be at the top of the boiler stacks without passing under the boilers and over and through the fire passages under the boilers. If it had ignited and burned while passing under the boilers it would have answered the purpose designed and made steam, thereby decreasing the amount of coal used *pro tanto*: The arrangements for conveying the gases from the top of the furnace to the boilers was a conduit properly constructed with valves to regulate the quantity to go under the boilers at a time. When the gas got under the boilers it ought to have burned and made steam.

Instead of that, it escaped unignited and burned at the top of the boiler stacks. Appellees' witnesses claim (in theory) that too much was let under the boilers at once; or that it was let in with too much air and could not burn.

Appellant's witnesses claim (from actual test) they did everything to regulate it and keep it from burning except under the boilers; but that owing to the short distance it had to travel under the boilers from the pressure by which it was forced it could not burn, hence escaped unutilized.

However it may be, we find practical furnace men unable to use the gas for fuel and find it escaping and coal being burned in its stead. We find that the appellees while in charge did the same. Can it be reasonably concluded that these practical men mismanaged these arrangements? and that these theorists are right? Or is it not more reasonable that these theorists are mistaken, and that these boiler furnaces are not rightly constructed?

Was not the appellant entitled to have the boilers rearranged, or to be paid the amount of its damages incurred by the misconstruction? If the latter, it will be about $50,000 00 per year; if the former, the cost of rearrangement, whatever that may be, about $35,000, from the testimony, to the battery. In either case, the amount would equal the balance claimed by the appellees.

The proofs bearing upon these questions last above cited as to the failure of the gas to burn under the boilers are those of

J. G. Chamberlain, transcript of record, pages 192 and 193;
G. W. Killebrew, transcript of record, page 222;
Alexander McIlwain, transcript of record, pages 223 and 224;
J. H. Partlow, transcript of record, page 242;
Fred Massey, transcript of record, page 246.

Fourth:

"In actions by which it is sought to declare and enforce a lien given by statute to mechanics and material men and the like every fact necessary to the creation of the lien must be alleged and proven."

"The statute requires it (the claim of lien) to be filed within the time, and that it was so filed must, as we have seen, be averred in the complaint and proved on the trial."

Cook vs. Rome Brick Co., Southern Reporter,

Vol. 12, p. 918. Supreme Court of Alabama, April 13, 1893.
See also, Phillips on Mechanic's Lien, sec. 402 et seq.
Corrugating Co. vs. Thacher, 87 Ala., 458.

This decision is conclusive against the right of appellees to enforce any lien against the property of appellant, because the proofs contained in the record do not disclose any filing of said claim of lien in the office of the judge of probate of Colbert county.

The statement in the petition of appellees [transcript of record, pages 1 to 6 inclusive], that there had been a claim of lien verified by oath of James C. Gray, January 18, 1889, and filed in the office of the judge of probate of Colbert county on the 18th day of January, 1889, was expressly denied in the answer of appellant [transcript of record, page 15, side page 25], and strict proof was demanded of every matter and thing set forth and alleged in petition of appellees whereby the claim of lien of said petitioners was sought to be established.

Appellees at the time of filing their petition also filed a copy of this affidavit of James C. Gray made in Morgan co., Alabama, on the 18th January, 1889, as the foundation of their claim of lien; but it does not appear from the record that such affidavit had ever even been filed in the office of the judge of probate of Colbert county. In transcript of record page 47, as part of the testimony of said James C. Gray, the following statement appears: "Intervenor then introduced the mechanical lien filed, marked exhibit No.8."

This obviously referred to the paper then of file and set forth in Transcript of Record, pages 9 to 12. Side pages 15 to 19. But the record does not disclose any claim of lien filed in the office of the judge of probate of Colbert county, nor anything answering the description of the claim of lien, other that the affidavit of said James C. Gray, above referred to, set

forth on pages 9 to 12 of Transcript of Record, and which shows that it was not filed with the judge of probate. But even if such filing in the probate court had appeared or could be inferred, it is contended that such would not be sufficient proof, without showing proper attestation as a record or transcript of same coming from the probate court of Colbert county; and there is no pretense that any such certified transcript was ever filed or offered in evidence before the special master.

The filing of the claim of lien in the office of the judge of probate of a county in the State of Alabama, being a proceeding or record of a state court, could only be proven in a Federal court by copy of same duly certified according to the acts of congress.

Revised Statutes (2d Ed., 1878) Sec. 905.
Pennoyer v. Neff, 95 U. S., 714 (7 head note), 732 and 733.

The enforcement of the claim of lien by appellees was in the nature of a proceeding *in rem;* and the right or title to subject the property should be clearly shown.

Pennoyer v. Neff, 95 U. S., 714, 733 and 734.

If it be held that the affidavit of Gray made and filed to establish the lien of appellees, was a paper not properly belonging to the probate court, but to the office of the clerk of such court, then it could have been introduced in evidence before the master only after being proved as provided by

Revised Statutes (2d Ed. 1878) Sec. 906.

Unless the claim of lien by appellees was shown by proof to be founded on the sworn statement duly filed in the office of the judge of probate of Colbert county, within six months from 8th August, 1888—the date of the completion of the furnaces—then the Federal court had no jurisdiction to find

and declare a lien in favor of appellees upon the property of appellant.

Thompson v. Whitman, 18 Wallace, 457 (3d head note.)

Fifth:

Filing the claim of lien properly sworn to in the office of the judge of probate is not giving the notice such as the statute requires to invest the mechanic or contracter with a lien. But notice of the same must be given, and this is only done by having the statement duly recorded.

"Filing the claim is preliminary to securing the lien, and the statute intended that notice thereof shall be given; but the notice intended and provided for by the statute is the record of the abstract required to be made by the judge of probate. The statement itself is not a record. * * * The statute is complied with when the statement is filed as required and the abstract thereof recorded."

Bell vs. Teague, 85 Ala., 221.
Chandler vs. Hanna, 73 Ala., 290.

2 Jones on Liens, Sec. 1389, 1390 note.

Under the law before the code of Alabama of was only required that the judge of probate should record an abstract of the claim of lien. The law in force at the date of this suit required the whole statement to be recorded.

Code of Ala., 1886, sec. 3024.

Sixth:

The court was without jurisdiction to decree a lien in favor of appellees against the property of appellant, because the lien at the time of the filing of the petition for its enforcement had become lost under the statutes of Alabama providing for mechanics' and contractors' liens and their enforcement.

In transcript of record, page 4, side page 5, appellees set forth that "the construction of said three furnaces were by your petitioners completed according to said contract and the

specifications therein contained, on the 8th day of August, 1888." In transcript of record, page 12, side page 159, it is shown that the petition of Gordon, Strobel & Laureau, for the enforcement of their alleged lien, was filed in the office of the Circuit Court of the United States for the Northern District of Alabama, at Huntsville, on the 11th February, 1889. Thus six months and three days had elapsed from the completion of the contract to the beginning of the action to enforce the lien.

Section 3041 of the Code of Alabama of 1886, in force at the time of the making of said contract for the construction of the furnaces and at the time of the beginning of said suit, is as follows: "Except in cases hereinafter provided, all liens arising under this chapter shall be deemed lost, unless suit for the enforcement thereof is commenced within six months after the maturity of the entire indebtedness secured thereby."

The appellees did not come under any of the exceptions provided by the Code of Alabama and set forth in sections 3042 and 3043 of the Code.

In Phillip's on Mechanics' Liens (2d ed.) section 10, the law respecting this class of liens is stated as follows:

"It is *sui generis*, essentially different from most other liens known to the law. Its existence is not to be presumed. It requires express words not only to create it, but when created. to limit its otherwise indefinite duration, and again, if limited in its period of existence, equally express words to continue it beyond that period. It is only a limited privilege, arising in positive enactment, which confers no right of sale without the process prescribed by law; and any essential departure from its directions will be faral to those who attempt to enforce it. In this strict adherence to the requirements of the law, there is deemed to be no inequity, as the party claims to fasten an unusual right udon the land of another with priority over other creditors."

HENRY B. TOMPKINS,
For Appellant.

Atlanta, Ga.

## SUPPLEMENT TO BRIEF.

I. Counsel desires to add after head Fourth on page 30 of Brief, the following:

Materials and labor furnished by appellees for alterations and repairs made to Furnace A after it was ruined and during the months of September and October, long after appellees had completed their contract on the 8th August, 1888, cannot come ahead of the mortgage bonds even if appellant is liable for such materials in any event; nor could such claim of $1194.50 be enforcible in the same action with the alleged balance due under the original contract

2nd Jones on Liens, sec's 1446, note 1; 1478, note 2; 1480, and 1597, note 2;

80 Mo. 265, Fulton Iron Works vs. North Centre, etc., Co.;

94 U. S. 545, Davis vs. Alvord.

Further, it is not stated in petition of appellees that the claim of lien filed in the office of judge of probate of Colbert county was recorded there; and this is fatal to the suit as the necessity for recording was as great as the necessity for filing the claim of lien. (Transcript of record pages 5 and 6, side page 8.)

2nd Jones on Liens, sec's 1389, 1390, note 1;

Code of Alabama, 1886, sec's 302 ', 3024.

II. Counsel further refers under clause sixth, page 33 of brief, to the following authorities:

2nd Jones on Liens, sec. 1443, note 1.

Upon failure and refusal of appellant to settle the amount alleged by appellees to be due them as provided in the contract (transcript of record page 8, side page 12) then appellees were relegated to their rights under the statutory lien laws of the State of Alabama, must have complied therewith and filed and recorded their lien within six months from the completion of the work, which appellees alleged and proved was on the 8th August, 1888.

2nd Jones on Liens, sec. 1536;

29 Illinois, 277, Gardner vs. Hail.

III. In case of Sheffield Furnace Co. vs. Witherow, 149 U. S., 574, it affirmatively appeared by exhibit to the bill that a statement of lien had been filed in the office of the judge of

probate, and had been therein duly recorded. It also appeared from the contract between the parties which was introduced in evidence that there was an express stipulation on the part of the contractor that the balance remaining due should be secured either by mechanic's lien or first mortgage on all the furnace company's interest in Sheffield. Neither of these substantive facts appear in the case now before the court; that is, it is no where made to appear, either in the pleadings or the proofs, that the statement of lien was filed in the office of judge of probate and duly recorded. Nor was it contemplated by the contract that the amount remaining due after the completion and acceptance of the furnaces should be secured by a mechanic's lien or a first mortgage; but only that a part of such balance should be paid in money within thirty days, and that the remainder should be secured by promissory notes at four, eight and twelve months, with collateral to the face value of the notes in the shape of mortgage bonds of the company.

IV. The amount of $7113.62 paid by appellees upon freight over thirteen and one-half cents per hundred pounds upon materials shipped, to construct the furnaces, from Cincinnati to Sheffield, being money advanced by appellees for the use and benefit of appellant, cannot be the foundation of any lien. (Transcript of record page 7, side page 11; page 3, side page 4; page 25, side pages 43 and 44.)

2d Jones on Liens, sec. 1359, note 4;

Phillips on Mechanics' liens (2d ed.) sec. 159a.

The affidavit of Gray, agent of appellees, transcript of record pages 9 to 12, did not mention any amount as being due for this excess of freight; but claimed $59,118 16 for work and labor done and material, fixtures, etc., furnished for the furnaces. (Transcript of record page 11, side page 18).

V. By statement of appellees (transcript of record page 9) the appellant had paid $514,500 on the contract during the progress of the work, the balance of the total price of $564,000, being $49,500. The amount due thus being less than $50,000 at completion of work, no cash was due but all to be paid in three notes at 4, 8 and 12 months. This agreement waived lien of contractors.

2 Jones on Liens, sec's 1534, 1535.

## APPENDIX.

*Sections of Lien Law of Alabama.*

I. CODE OF ALABAMA of 1886.

SECTION 3018 (3440-3441). *Lien declared.*—Every mechanic, or other person, who shall door perform any work or labor upon, or furnish any material, fixtures, engine, boiler, or machinery for any building or improvement on land, or for repairng the same, under or by virtue of any contract with the owner or proprietor thereof, or his agent, trustee, contractor, or sub-contractor, upon complying with the provisions of this chapter shall have a lien therefor on such building and improvement, and on the land on which the same is situated, to the extent, in ownership of all the right, title, and interest owned therein by such owner or proprietor, and, in area, of the entire lot or parcel of land if in a city, town, or village, or, if not in a city, town, or village, of one acre; but the lien of employes of the contractor and persons furnishing materials to him shall extend only to the amount of any unpaid balance due the contractor by the owner or proprietor; and such employes and materialmen shall also have a lien on such unpaid balance.

3022. *Verified statement to be filed with judge of probate; filing and contents of statement.*—It shall be the duty of every original contractor, within six months, and of every journeyman and day laborer, within thirty days, and of every other person entitled to such lien, within four months after the indebtedness has accrued, to file in the office of the judge of probate of the county in which the property upon which the lien is sought to be established is situated, a statement in writing, verified by the oath of the claimant, or some other person having knowledge of the facts, containing a just and true account of the demand secured by the lien, after all just credits have been given, a discription of the property on which the lien is claimed, and the name of the owner or proprietor thereof, if known, but no error in amount or name of the owner

or proprietor shall effect the lien; and unless such statement is so filed, the lien shall be lost.

3024. *Record of statement and fee therefor.*—The judge of probate shall indorse on such statement the date of its filing, and shall record the same in a book kept for that purpose, which shall be properly labeled and indexed, and note therein the date of the filing; for all of which he shall receive one dollar, which shall be secured to the party filing the statement by such lien.

3025. *Selection of land, when tract exceed one acre.*—When the land on which the building or improvement is situated is not in a city, town, or village, and exceeds in area one acre, the original contractor, or if he dies, is absent from the state, or, for any cause, refuses or fails, on demand to do so, any other party entitled to the lien, may, at any time prior to filing his statement in the office of the judge of probate, select the one acre which shall be subject to the lien; such selection to include the site of such building or improvement, and the land contiguous thereto, and to constitute but one lot or parcel.

3034. *Issues, verdict and judgment.*—Any defendant, by appropriate plea, may put in issue the fact of indebtedness, or the existence of the lien, or both, and may interpose any other defense applicable to the suit; and if the court by its finding, or the jury by their verdict, as the case may be, ascertain that the plaintiff has a lien as claimed, judgment shall be rendered for the amount secured thereby, inteaest and costs against the party liable for the same, and establishing the lien, and condemning the property to sale for the satisfaction thereof; but if the finding or verdict is for the plaintiff only on the issue of indebtedness, a judgment shall be rendered in his favor for the amount thereof as in other cases.

3035. *Judgment by default.*—Judgment by default may be rendered against any defendant, except infants and persons *non compos mentis*, who, after service has been perfected on him, fails to appear within the time required by law as in other cases.

3036. *Enforcement of judgments.*—Judgments establishing the lien, and ordering the property sold for the satisfac-

tion thereof, may be enforced by writs of *fieri facias* or *venditioni exponas;* but if by *fieri facias*, the clerk shall indorse thereon the fact that the lien has been established, and a description of the property.

3038. *When lien may be enforeed in equity.*—Any lien provided for under the provisions of this chapter, when the amount claimed is not less then $100, may also be enforced by bill in equity without alleging or proving any special ground of equitable jurisdiction.

3041. *Limitation.*—Except in cases hereinafter provided, all liens arising under this chapter shall be deemed lost, unless suit for the enforcement thereof is commenced within six months after the maturity of the entire indebtednesss secured thereby.

3042. *Additional time to representative for filing statement and bringing suit.*—If any person entitled to a lien under this chapter shall die before the time has elapsed for filing his statement in the office of the judge of probate, without filing it, his personal representative may file the same within three months after the grant of letters; and if such person shall die before commencing suit for the enforcement of his lien, and the lien is not lost at the time of his death, his personal representative may bring suit for the enforcement thereof at any time within six months after the grant of letters.

3043. *Suits against representative within six months after grant of letters.*—The provisions of this code, prohibiting the bringing of suits against personal representatives within six months after the grant of letters, shall not apply to suits brought under the provisions of this chapter.

From Revised Statutes of United States (2d edition) 1878, page 171:

Sec. 905. The acts of the legislature of any state or territory, or of any country subject to the jurisdiction of the United States, shall be authenticated by having the seals of such state, territory or country affixed thereto. The records and judicial proceedings of the courts of any state or territory, or of any such country, shall be proved or admitted in any

other court within the United States, by the attestation of the clerk and the seal of the court annexed, if there be a seal, together with a certificate of the judge, chief justice, or presiding magistrate, that the said attestation is in due form. And the said records and judicial proceedings, so authenticated, shall have such faith and credit given to them in every court within the United States as they have by law and usage in the courts of the state from which they are taken.

Sec. 906. All records and exemplifications of books which may be kept in any public office of any state or territory, or of any country subject to the jurisdiction of the United States, not appertaining to a court, shall be proved or admitted in any court or office in any other state or territory, or in any such country, by the attestation of the keeper of the said records or books, and the seal of his office annexed, if there be a seal, together with a certificate of the presiding justice of the court of the country, parish or district in which such office may be kept, or of the governor, or secretary of state, the chancellor or keeper of the great seal, of the state or territory or country, that the said attestation is in due form and by the proper officers. If the said certificate is given by the presiding justice of a court, it shall be further authenticated by the clerk or protho-notary of the said court, who shall certify, under his hand and the seal of his office, that the said presiding justice is duly commissioned and qualified; or if given by such governor, secretary, chancellor, or keeper of the great seal, it shall be under the great seal of the state, territory, or country aforesaid in which it is made. And the said records and exemplifications, so authenticated, shall have such faith and credit given to them in every court and office within the United States as they have by law or usage in the courts or offices of the state, territory, or country, as aforesaid, from which they are taken.

Office Supreme Court U. S.
FILED.
DEC 13 1893
JAMES H. McKENNEY,
CLERK.

# In the Supreme Court of the United States.

Term No. 176.

THE SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY, *Appellant*,

*versus*

GORDON, STROBEL & LAUREAU (Limited), COMPOSED OF FREDERICK W. GORDON, VICTOR C. STROBEL AND LEWIS S. LAUREAU, AHD THOMAS G. BOYLE.

BRIEF AND ARGUMENT FOR APPELLEES.

BY

W. A. GUNTER.

# In the Supreme Court of the United States.

Term No. 176.

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THE SHEFFIELD AND BIRMINGHAM COAL, IRON AND RAILWAY COMPANY, *Appellant*,

*versus*

GORDON, STROBEL & LAUREAU (Limited), COMPOSED OF FREDERICK W. GORDON, VICTOR C. STROBEL AND LEWIS S. LAUREAU, AHD THOMAS G. BOYLE.

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## BRIEF AND ARGUMENT FOR APPELLEES.

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### STATEMENT OF THE CASE.

The appellees filed an intervening petition in a cause pending in the Circuit Court for the Northern District of Alabama for the foreclosure of a deed of trust, setting up and claiming the benefit of a Mechanic's lien on certain furnace property described in the petion, to secure the payment of a large balance due them as builders.—Record, 1 to 12.

The defendants to this petition, all of whom appeared and answered, were the Central Trust Company of New York, who was the trustee under the deed of trust sought to be foreclosed, embracing the property mentioned in the intervening petition, the Sheffield, Birmingham Coal, Iron and Railway Company (the appellant in this case), who was the mortgagor, Jacob G. Chamberlain, who was receiver in said cause, and one Charles D. Woodson.—Record, 6 and 15.

A consent decree was rendered, by which the court assumed jurisdiction and referred it to the Special Master to report upon the intervening claim and the special defenses set up thereto in the answers.—Record, 13–14.

In compliance with the decree the Master, after a full hearing, reported that the intervenors were to erect certain works for a given price according to certain plans and specifications; that the superintendent of appellant was to pass the work every two weeks, and if to his satisfaction it was to be a final acceptance so far as done; that the agreed price was $564,000.00. And that the evidence showed, without conflict, that appellant's superintendent did supervise and inspect the work and passed it from time to time, making changes as he thought proper. And that when the work was finished, the contractors asked a final acceptance, and this was given by the same superintendent on the direction of the president of appellant. The Master further reported that the evidence did not sustain the defenses of the respondents, and that the contractors (appellees) were entitled to be paid the contract price of their work. A balance of $57,808.12 was reported due, with interest at eight per cent. from 18th September, 1888, and that the intervenors were entitled to a mechanic's lien on the premises described in the petition under and according to the law of Alabama.—Record, 24–5–6.

Certain exceptions were filed to the report of the Master and they being overruled and the report confirmed, this appeal is prosecuted by one of the defendants below to reverse this decree.

ARGUMENT.

I. The appeal was taken on the 15th day of July, 1890, and to this day, December, 1893, no assignment of errors has been made. The law, Revised Statutes of the United States, secs. 997, 1012, requires that an assignment of errors shall be annexed to and returned with any writ of error or appeal. And the rules of this court (Rule 19, sec. 4) pro-

vide that when there is no assignment of errors, as required by law, counsel will not be heard except at the request of the court; and that errors not specified according to the rule will be disregarded; reserving to the court the right, at its option, to notice a plain error not assigned or specified. We do not think that any plain error can be discovered in the record in this case, requiring the reversal of the decree; and we respectfully insist that this is a plain case calling for the application of the rule. We therefore ask that this case be affirmed, with damages, for the want of the assignmert of errors by the appellant according to law and the rules of this court.

II. Assuming that the foregoing position may not be sustained, we proceed to notice the errors which we conjecture may be insisted on.

The decree of reference was by consent, and therefore no complaint can be made of it.

By reference to that decree (Tr. 13, 14) it will be seen that the Master was not required to report the evidence. And his report (Tr. 24) nowhere states that all, or any of the evidence before him is or was reported. The testimony need never be reported further than is relied on to support, explain or oppose a particular exception.

Harding v. Handy, 11 Wheat. 127.

The only errors which can be assigned, must arise upon the exceptions to the Master's report.

It is evident that any conclusion of the Master founded upon evidence before him, could never be called in question upon an exception, in the absence of a certificate from the Master, that, all the evidence upon which he acted upon any particular point was before the court called upon to try the exceptions.

And as we have not the certificate in this instance, the exceptions filed to the Master's report (Tr. 26), all of which require a consideration of the evidence before the Master, must be overruled by this court, as they were by Circuit Court.—Tr. 28.

III. The exceptions to the Master's report it seems should also be dis-allowed and overruled because they were not properly taked.

The rule is that they can only be filed upon objections taken before the Master. And the reason of the rule is, that the Master may, upon his attention being called to specified errors, correct them *sua sponte*.

McMicken v. Perrin, 18 How. 507.
Story v. Livingston, 13 Pet. 359.
1 Maddox Chan. 340, 555.
Harding v. Handy, 11 Wheat. 126–130.
1 Foster's Fed. Prac. § 315.
2 Dan'l Chan'y Prac., 4 Am. Ed., Chap. 29, § 1, p. 1302.

"Exceptions are always to be confined to objections allowed or overruled by the Master."

Copeland v. Crane, 9 Pick, 73–8.
Byington v. Wood, 1 Paige, 145.
Gordon v. Lewis, 2 Sumner, 143.
Methodist E. Church v. Jaques, 3 John. ch. 80–1.

And should distinctly point out the finding and conclusion of the master sought to be reversed.

Foster v. Godard, 1 Black, 509.
2 Desty Fed. Pro. notes to rule, 83, p. 1191.

The exceptions in this case are not founded on objections taken before the master, and therefore can not be the basis of an appeal.

IV. But supposing that the foregoing points are not sustained, we proceed to consider another objection to the exceptions.

There is really only one exception in this case. The language is, that the exceptors:

"Except to so much and such parts of the report . . . as are below specially assigned, and for the reasons below stated. Defendants except to so much of said report and the findings of the Master in reference thereto as determines:

(1.) That the defenses set up by the defendants are not sustained by the evidence.

(2.) That the petitioners, . are entitled to be paid the contract price for their work and materials.

(3.) That the sum of ($57,808.12), with interest from the 18th of September, 1888, is the amount due the intervenors; and,

(4.) That intervenors have a lien on the property described in their petition; and for grounds or reasons for such exceptions they assign the following:

1st. Because the evidence in the case sustain the defenses set up by the defendant and showed, 2nd, that the work and materials done and furnished by intervenors were not up the requirement and guaranty of their contract, by reason of which the value of the plant as built and equipped was worth sixty or seventy-five thousand dollars less than the contract price; and, 3rd, because such report is contrary to the weight of testimony on each of the matters so reported."

Now, it is plain that the last three numbered matters are as they are stated to be, mere reasons or grounds for previous exceptions. And it is no less evident that the first four numbered matters are mere designations of the different conclusions of the Master generally excepted to under the previous words: "Defendants except to so much of said report, and the findings of the Master in reference thereto as determined."—Tr. 27.

This exception is a mere general expression of dissatisfaction with, or "wholesale exception" to the report of the Master, and its consideration involves a re-hearing of the whole reference by the court, without the advantage possessed by the Master of hearing the whole evidence and of seeing the witnesses. If such general exceptions were regarded, the entire benefit of the reference to the Master would be lost.

Story v. Livingston, 13 Pet. 366.

Byington v. Wood, 1 Paige, p. 145.

Chappedelaine v. Dechenaux, 4 Cranch, p. 315.
Dexter v. Arnold, 2 Sumner, p. 108.

The rule therefore, is, "that exceptions to a report of a Master must state article by article, those parts of the report which are intended to be excepted to."
Story v. Livingston, 13 Pet. 359.

And "should be precise and raise well defined issues."
Stanton v. R. R. Co., 2 Wood's 507.

"The exception should distinctly point out the finding and conclusion of the Master which it seeks to reverse."
Foster v. Goodard, 1 Black, 509.

Good examples of exceptions and of the findings and report of the Master thereon are shown in the case last cited. It will be seen by reference to them that the exceptions itemize the errors complained of, and the Master reports his conclusion with the evidence on each exception, so that the court does not have to go into a general re-hearing of the whole proceedings in the Master's office.
See, also, 4 Cranch, 315.

The proper manner of proceeding in the matter of exceptions is well pointed out in the case of Mahone v. Williams, 39 Ala. 222, 225, wherein it is said, in speaking of the necessity of disregarding general exceptions: "The object of a reference to the Master is to aid the chancellor. But the reference certainly can neither enlighten him, nor facilitate is labors, if he is left, as in this case, to consider all the questions as original propositions, and search through the file for the evidence bearing upon them. Indeed, it would have been obviously better for him to have had no reference, and to have required the parties to come before him and produce the testimony bearing upon the different items."
Donnell v. Col. Ins. Co., 2 Sum. 366.
2 Desty's Fed. Pro., p. 1191 R. 83, n.
1 Foster's Fed. Prac., sec. 315.
Alexander v. Alexander, 8 Ala. p. 804.

The exception in this instance then should be disallowed, because it is a general or "wholesale exception," calling in question the conclusion of the Master upon all the evidence in the case, without any certificate showing that all the evidence or any of the evidence before the Master upon any point is in the record.

Story v. Livingston, 13 Pet. 366.
Alexander v. Alexander, 8 Ala. 804.
Royal v. McKenzie, 25 Ala. 363.
O'Reily v. Brady, 28 Ala. 535.
Foster v. Gresset, 29 Ala. 393.
2 Desty, *supra.*
Harding v. Handy, 11 Wheat. 103, 126.

V. The exception should also be overruled for other reasons. "Every presumption is in favor of the correctness of the decision of a master. If the testimony is conflicting, the court will rarely interfere with the master's decision on the facts." "The court must be clearly satified that there has been an unquestionable error."

1. Foster's Fed. Prac., § 315.
Tilghman v. Proctor, 25 U. S., p. 149.
Callaghan v. Myers, 128 U. S. 617–666.
Medsker v. Bonebrake, 108 U. S. 66.
Donnell v. Col. Ins. Co., 2 Sum. 366–71.
Mason v. Crosby, 3 Woodb. & Minn. 258.
Mahone v. Williams, 39 Ala. p. 221.

Leaving out of consideration for the present the exception to that part of the report finding that the Intervenors had a lien on the property described in their petition, the other three specifications simply amount to an objection and exception to the conclusion of the master, on all the evidence before him, that the plaintiffs had proved their claim to the amount of $57,808.12, with interest from 18th September, 1888, and thus involves the conclusion of the master on all the evidence before him.

Under the circumstances of this case it is impossible to

say, that there is any clear or unquestionable error comm
ted by the master in his conclusions. The very utmost th
can be said is, that on some minor points, really not touc
ing the general merits of the case, there was a conflict
the evidence.

The exception does not point out, or "lay its finger on
any particular item improperly allowed, and refer the cou
to the particular evidence relating thereto, and the ruli
and explanation of the master thereon; but is leveled at t
general conclusion, that the plaintiffs' claim was proved
the amount stated, and consequently that the defenses we
not made out. Supposing that there was a conflict in t
evidence, the presumption is that the conclusions of t
master are correct, and they will not be disturbed unless
is made clear that there is unquestionable error. And this
impossible when the objection is not taken before the ma
ter and the evidence on which he acted is not shown.

1 Fos. Fed. Pra. § 315.

In reference to that part of the exception relating to t
finding of the master of a lien on the property, there is sti
another objection. By reference to the answer (Tr. 15, 1
it will be seen that the appellant made no denial of the lie
set up in the petition except as relating to the two iten
mentioned on page 19 of the transcript, one of $9,668.
charged as "freight excess payments as per 13 1-2 claus
contract," the other of $1, 104.50 charged as "extra materi
furnished September 21, Oct. 16, and Oct. 29, 1888, as pe
Nov. 1st statement."

The objection by way of exception to any item in the ma
ter's report of course could not be broader than the issue
of the pleading. The answer here left unchallenged th
lien of the plaintiff below except as to the items above me
tioned, and the only issue before the master on this matte
was as to the lien for the said items.

United States v. Col. & Ore. L. Co., 148 U. S. 31.

The exception on the contrary calls in question the allow
ance of the lien by the master for any part of the balanc

found due. It was thus too broad, and should on that account be disallowed; since it is clear no fault can be attributed to the master in allowing the lien to the extent it was admitted by the pleadings.

VI. As this record does not furnish the evidence and material for the trial of this case over again, we must decline that difficult and impossible task.

Under this head we will notice only one point, the effect of the acceptance of the work by the superintendent.

The Master reports that the contract shows that the superintendent of appellant was to pass upon the work every two weeks and if to his satisfaction it was to be a final acceptance of the work so far as done. And the Master reports that the evidence showed without conflict that the superintendent made inspections and supervised the work and caused changes to be made in it from time to time and accepted it when, in his judgment, it was in compliance with the contract. And that a final acceptance was given on the 8th of August, 1888, by the same superintendent to whom the matter was referred by the president of the appellant. Tr. 24.

The exceptions of the appellant can have no standing without disregarding the estoppel of this acceptance.

There is nothing in the answer, proceedings or exceptions charging any fraud or *mala fides* on the part of the superintendent.

The simple question then is, can any tribunal under such circumstances, with any weight of evidence not showing fraud, go behind the judgment of the superintendent and substitute for it the opinions and judgment of other persons, wether judge, jury or witnesses.

All the authorities hold, that the act of an achitect or any third person, whose decision the parties agree to abide by, stands as the judgment of an arbitrator, and in the absence of fraud or bad faith, is "final and conclusive." And that when the very purpose or particular terms is to prevent "disputes," the highest reason demands that parties should be "concluded" by them. (Phœnix Ins. Co. v. McLoon, 100

Mass. 476–7.) And "that no more error or mistake of judgment will vitiate his determination, the very object of his appointment being to prevent and exclude contention and litigation, and hence that nothing short of fraud or *mala fides* · · in the exercise of his power · · will dispense with the strict legal effect" of his decision. And that, "To substitute for it" (the decision of the person selected) "the *opinions* and judgment of other persons, whether *judge, jury* or *witnesses*, would be to *annul* thec ontract, and *make* another in its place."

Lynn v. B. & O. R. Co., 45 Amer. Rep. 741–6–7.
B. & O. R. Co. v. Brydon, 57 Amer. Rep. 326.
Clarke v. Watson, 18 Com. Bench (N. S.) 278.
B. & O. R. Co. v. Polly, 14 Gratt. 447.
Wilson v. York & M. L. R. Co., 11 G. & J. 58.
Sweeney v. U. S., 109 U. S. 549.
Martinsburg v. Potomac R. Co., 114 U. S. 549.
Sharpe v. San. Paulo. R. R. Co., L. R. 8 Ch. App. 597.
Grube v. Schultheiss, 57 N. Y. 669.
Wyckoff v. Meyers, 44 N. Y. p. 145.
Smith v. Brady, 17 N. Y. 176 (72 A. D. 442).
Stuart v. Keteltas, 36 N. Y. 388.
Glacius v. Black, 50 N. Y. 151.
Moore v. Kerr, 65 Cal. 521.
1 Addison on Cont., pp. 57[illegible]–7–8.
Hostteter v. Pittsburg, 107 Pa. St. 419.
1 Whart. on Con. §§ 593–4.
Snell v. Brown, 71 Ill. 133.
Korf v. Lull, 70 Ill. 420.
Taylor v. Renn, 79 Ill. 181.
Dingley v. Greene, 54 Cal. 333.
Hudson v. McCartney, 33 Wis. 331.
Tetz v. Butterfield, 54 Wis. 242.

It was impossible for the Master, without the proper predicate in allegation and proof of fraud, to disregard the estoppel between the parties arising from the acceptance of the work by the party mutually selected for the purpose.

This is another and final reason for sustaining the report of the Master and the decree of the lower court.

VII. The appellees respectfully insist that if there ever was a plain case calling for the allowance of damages for delay arising from an appeal, this is that case.

This appeal has been taken and prosecuted by a purchaser of the property, who in all likely-hood discounted in the price agreed to be paid for the property the full amount of the claim and who will thus loose nothing if compelled to pay the debt.

The resistence of the payment of this claim by this appeal, we think the evidence and circumstances abundantly show, could have had no other foundation than a desire by means of the "law's delay" to profit the appellant and injure the appellees.

We insist that this court cannot attribnto any other motive to the appellant. It seems to be impossible to ascribe to the appellant any *bona fide* belief that any court would vacate the honest judgment of an arbitrator duly exercised without allegation and evidence of fraud. Or that "wholesale exceptions" to a Master's report, founded on such judgment and supported presumptively by evidence, would be allowed, when they were not taken and presented to the lower court in such manner as to be at all considered. It must be assumed that the appellant knew the law, and the futility of the attack by this appeal on the report of the Master and the decree of the lower court. Illusory hopes, hower honest, of overruling settled principles, cannot of themselves, we submit, relieve the appellant of a purpose to delay the execution of the decree below. We therefore respectfully ask for damages in this case for the delay caused by the frivolous appeal taken in July, 1890.

W. A. Gunter
for appellees

FILED.
DEC 22 1893
JAMES H. McKENNEY,
CLERK.

IN THE

# Supreme Court of the United States.

**OCTOBER TERM, 1893.**

*Term No., 176.*

SHEFFIELD & BIRMINGHAM COAL, IRON AND RAILWAY COMPANY, APPELLANT,

*vs.*

GORDON, STROBEL & LAREAU (LIMITED), COMPOSED OF FREDERICK W. GORDON, VICTOR O. STROBEL, LEWIS S. LAREAU, AND THOMAS G. BOYLE.

APPEAL FROM CIRCUIT COURT OF THE UNITED STATES FOR THE NORTHERN DISTRICT OF ALABAMA.

## Additional Argument for Appellees by R. C. Brickell and W. A. Gunter.

JUDD & DETWEILER, PRINTERS, WASHINGTON, D. C.

IN THE

# Supreme Court of the United States.

**OCTOBER TERM, 1893.**

*Term No., 176.*

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APPEAL FROM CIRCUIT COURT OF THE UNITED STATES FOR THE NORTHERN DISTRICT OF ALABAMA.

## Additional Argument for Appellees by R. C. Brickell and W. G. Gunter.

*a.*

Referring to the arguments on file for a statement of the case, this is addressed to the merits of the case, on the supposition that the Court undertakes to revise the rulings and findings of the master on this record and without any statement whatever from him of what evidence was before him.

I. As to the supposed guaranty involved in the words of the contract:

"All *work* to be done in a good and workmanlike manner and of suitable material, and each part to be adequate in design, strength, capacity, and workmanship for the purpose to which it is intended." (Tr., 7.)

The answer (Tr., 17) did not set up any special or general defense on this or any other *warranty*, but only insisted that the furnaces "were not built and constructed according to the plans and specifications * * * in various ways, as follows," setting out *certain* things that were alleged to be lacking, as not conforming to the specifications (Tr., 17–19). These special defenses were met before the master and shown to be groundless.

The evidence was undisputed that the plans and specifications were adopted by the appellant as its own after having made alterations in them to suit its own views and requirements, and the appellant in doing this relied entirely on the judgment of its own experts. (Tr., 101, '2.)

The evidence was also uncontradicted that the plant was constructed according to the plans and specifications thus adopted by the appellant (Tr., 103). The builder was bound to conform to these plans and specifications. The master was therefore correct in holding and finding that the special defenses set up by appellant were not sustained. The exception of the appellant (Tr., 25), which could not be and is not broader than the pleadings, does not go on the idea of a general warranty. The exception is in effect only that the master found against the *special* defenses set up.

There is, then, nothing in the answer or exceptions to found any claim on the supposed general warranty above

referred to, and, if there was, it is evident that that warranty related only to "*the work*" *of executing the specifications.* "Your superintendent shall pass on *the work* every two weeks," &c., and "all work *shall be done* in a good and workmanlike manner," &c., and if not so done and to the satisfaction of the superintendent "we agree to make it so as rapidly as possible," are all cognate clauses in the same part of the contract and do not refer to the plan and specifications as the matter "to be done," and if not "done" to the satisfaction of the superintendent "as to quality of material and character of workmanship" that it should be made so "as rapidly as possible."

"The *work*" was warranted, and nothing else, by the similar clause in the same sentence. The word work must mean the same in the same when used in the same connection, and in the other clauses in the same sentence and the succeeding one it plainly refers only to the *execution of the plans.*

Judge Pardee, then, construed the clause correctly as not covering a warranty of the plant as a whole; but even if he did the evidence is that the plant was perfect in all its details and that bad results came about from bad management. The acceptance by the superintendent is conclusive that the specifications were followed.

II. The claim set up in the answer about damages from the blowing in of the furnaces was abandoned on the trial and is not the subject of any special exception. (Tr., 273.)

III. By reference to page 8 of the Transcript it will be seen that a proposition was submitted in the contract by

which a guaranty and warranty of the entire plant was to be given, and under which the balance above 90 per cent. of the original cost and the $20,000 additional to be paid for the guaranty were not to be paid until certain named results were attained; and counsel argue from this that the results, or certain results named by him, were to be attained, and that there was a warranty in that respect, though this proposition was never accepted. It is admitted that it was never accepted. (Tr., 273.)

This idea is entirely unsupported by the terms of the contract, which as accepted contained only two warranties—one in reference to the *work* above mentioned and which the superintendent was to inspect and have performed, and which was thus concluded by his acceptance, the other relating to the engines. (See specifications, p. 36.)

This latter we will presently consider. Recurring now to the argument that a warranty resulted from the terms of the unaccepted proposition, we submit that, besides not being supported by the terms of the contract nor counted on as a special or general defense in the answer, it is not counted on in the exceptions, and, besides, the evidence of the most competent witnesses, including the superintendent of appellant, Edward Doud, show that the plant was perfect in all details and as a whole.

IV.—In reference to the lien of appellees, the petition of intervention avers "that on the 18th day of January, 1889, they filed in the office of the judge of probate of the county of Colbert, in the State of Alabama, in which county said furnaces and land are situate, their claim of such lien," &c. (Tr., 5.)

The master finds that "on the 18th of January, 1889, a verified statement of the amount claimed to be due on this contract" (the one under which the furnaces were built) "was filed with the judge of probate of Colbert county in substantial conformity with sections 30–32 of the Code of Alabama," &c. (Tr., 25.)

And further finds that petitioners have a mechanic's lien under the statute. (Tr., 26.)

The appellant asks the Court to presume that the master acted without proper evidence on this head, because the record which it has brought up does not contain such evidence, when there is no statement from the master of the evidence on which he acted, and when no objection appears to have been taken to the want or sufficiency of proof on this head, and when no specific exception is taken to the report as to the character or want of evidence, but only *one general exception* to the finding on a number of points in favor of appellees.

On page 47 of the Transcript there appears to have been introduced a mechanical lien, Exhibit No. 8, which is not in the record. But if this statement was not in the record no court can presume error. It must be shown by the appellant, and the evidence on which the master acted must be before the Court on a report from him; otherwise the presumption is that his finding was duly supported by competent and sufficient evidence.

In conclusion on this point and in addition to the remarks in the brief on file in reference to the conclusiveness of the master's report, we beg to refer to the case of Kimberly *vs.* Arms, 129 U. S., 512, which is very much like this case.

Here the decree of reference was by consent, and the findings of the master are judicial in the highest sense and cannot be vacated or disregarded without both duly verified and sufficient data for so doing; and, as the appellant has not taken the pains to have its case presented so as to show the evidence on which the master acted, it is impossible to disregard his report or impute error to it.

V. In reference to the point that the suit to enforce the lien was not commenced in six months after the *maturity* of the entire debt we need do no more than refer to the admitted facts (see Code of Ala., § 3041, set out in Appellant's Brief, p. 37). The balance above 90 per cent. of the cost was not due, as counsel would induce the Court to believe, on the completion of the work, but at thirty days and at four, eight, and twelve months thereafter (Tr., p. 8). The work was finished on the 8th August, 1888, and accepted 18th August, 1888, and suit commenced on 11th February, 1889 (Tr., 24, 12, 56). Besides, the rule is that when a receiver is appointed, the appointment is for the benefit of all persons, and their rights stand as at the date of appointment, which is in effect an injunction against suits *in rem*; but this principle need not be invoked, as the suit was in ample time.

VI. We admit, as above stated, that there was a warranty as to the engines (Tr., 37); but there is no count on this in the answer or the exceptions or in the argument. The argument (see Appellant's Brief, p. 28) that the weight of

the testimony clearly shows that there is a deficiency in the boiler and engine capacity.

But the plans and specifications called for a certain number of engines of a given size. (Tr., 36.)

The answer and defense was "that the blast engines are too light to run up to the speed they *should* do in order to bring the furnace up to its *best* capacity and output, and that they will not stand and enable the furnace to be put up to its best work, * * * and that there should be eight engines." (Tr., 19, top.)

There is no averment of breach of the special warranty of the engines (Tr., 37), which only related to certain tests which they might be put to. These tests it was competent for appellant to waive, and it did so by accepting the work unconditionally through its superintendent; and, as we have said, there is no count anywhere on this warranty. If eight engines or more boiler power was wanted it should have been so *nominated* in the specifications. Parties are presumed to know what they want, and when they get what they contract for there is no basis for complaint.

The evidence, moreover, is conclusive that the engines were perfect and as heavy as any others doing the same work and of same dimensions.

Hammond's dep., Tr., 261 *et seq.*
Doud's dep., 99 *et seq.*
Gordon's dep., 58 *et seq.*
Blakey's dep., 89 *et seq.*

VII. In reference to the deficiency of boiler power, the same remarks as those made in reference to the engines are applicable. The specifications were filled, so that the appellant got what was contracted for; and the deposition of the boiler expert, Rowell, shows why the boilers did not come up to appellant's expectations.

Dep. of Rowell, Tr., 67.

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